BCS LEVEL 6 PROFESSIONAL GRADUATE DIPLOMA IN IT

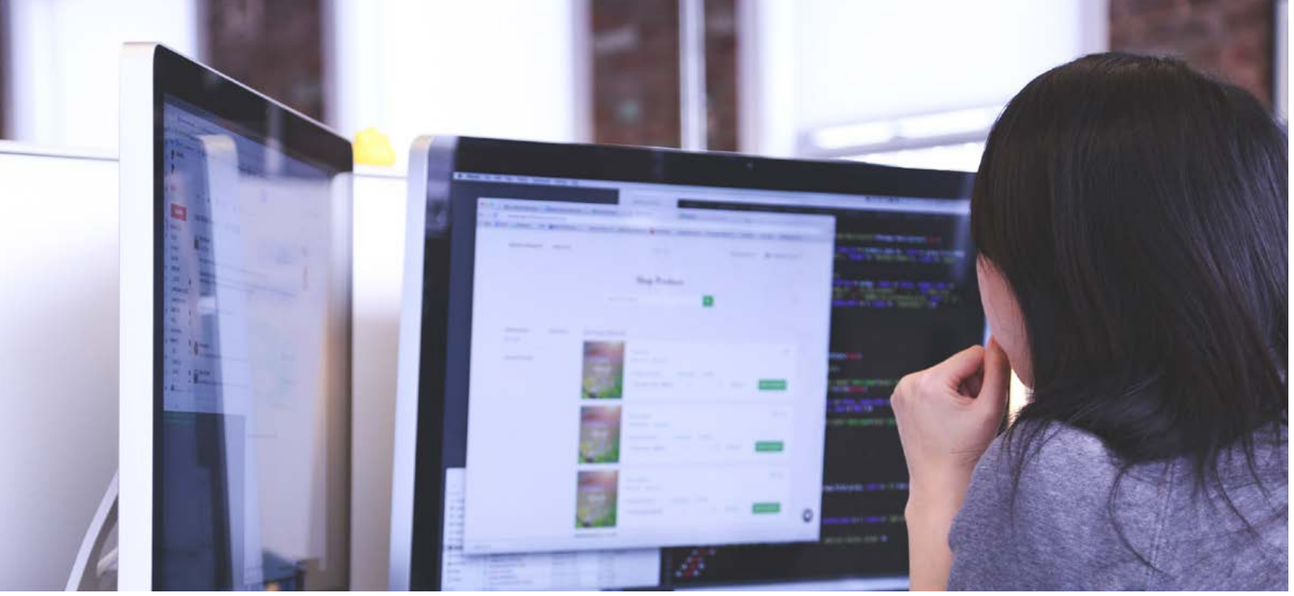
SOFTWARE ENGINEERING

SYLLABUS

THIS QUALIFICATION WILL BE RETIRING IN 2026

September 2023 v3.1

CONTENTS



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.

Software Engineering 2 optional module

The Software Engineering 2 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 develop an understanding of software development and its evolution, as well as enhancing their existing knowledge of developing and maintaining high-quality software systems. Their understanding will be based on the discipline's theoretical foundations and demonstrated by critically applying software engineering theory to real-world problems in practical applications. Throughout the module, candidates will gain a thorough understanding of the processes used in software systems engineering, software products, and theory, laws and models, as well as the relationships between these areas.

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 who are interested in career opportunities such as software, web or app development, application support analysis, or programming.

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

ASUP4

Maintains application support processes, and checks that all requests for support are dealt with according to agreed procedures. Uses application management software and tools to investigate issues, collect performance statistics and create reports.

PROG4

Designs, codes, verifies, tests, documents, amends and refactors complex programs/scripts and integration software services. Contributes to selection of the software development approach for projects, selecting appropriately from predictive (plan-driven) approaches or adaptive (iterative/agile) approaches. Applies agreed standards and tools, to achieve well-engineered outcomes. Participates in reviews of own work and leads reviews of colleagues' work.

DESN4

Designs components using appropriate modelling techniques following agreed architectures, design standards, patterns and methodology. Identifies and evaluates alternative design options and trade-offs. Creates multiple design views to address the concerns of the different stakeholders of the architecture and to handle both functional and non-functional requirements. Models, simulates or prototypes the behaviour of proposed systems components to enable approval by stakeholders. Produces detailed design specification to form the basis for construction of systems. Reviews, verifies and improves own designs against specifications.

DLMG5

Defines systems development projects which support the organisation's objectives and plans. Selects, adopts and adapts appropriate systems development methods, tools and techniques selecting appropriately from predictive (plan-driven) approaches or adaptive (iterative/agile) approaches. Ensures that senior management is both aware of and able to provide the required resources. Facilitates availability and optimum utilisation of resources. Monitors and reports on the progress of development projects, ensuring that projects are carried out in accordance with agreed architectures, standards, methods and procedures (including secure software development). Develops road maps to communicate future development activity.

TEST4

Accepts responsibility for creation of test cases using own in-depth technical analysis of both functional and non-functional specifications (such as reliability, efficiency, usability, maintainability and portability). Creates traceability records, from test cases back to requirements. Produces test scripts, materials and regression test packs to test new and amended software or services. Specifies requirements for environment, data, resources and tools. Interprets, executes and documents complex test scripts using agreed methods and standards. Records and analyses actions and results, and maintains a defect register. Reviews test results and modifies tests if necessary. Provides reports on progress, anomalies, risks and issues associated with the overall project. Reports on system quality and collects metrics on test cases. Provides specialist advice to support others.

HCEV4

Designs and develop users' digital and off-line tasks, interaction and interfaces to meet agreed usability and accessibility requirements. Translates concepts into outputs and prototypes and captures user feedback to improve designs. Specifies appropriate tools, methods and design patterns. Evaluates alternative design options and recommends designs taking into account performance, usability and accessibility requirements. Interprets and follows visual design and branding guidelines to create consistent and impactful user experience.

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 a critical understanding of software systems engineering theory in the form of laws and models, and of associated methods, tools, and techniques.
- Critically apply the above to practical situations found throughout the Software Life Cycle from software requirements engineering, system specification, design, implementation, validation and verification, through to maintenance and evolution; and to recognize the potential for software reuse throughout the life cycle.
- Appreciate the importance of software project management, software economics, estimation and planning as well as the management of software project teams and their productivity.
- Discuss critically recent advances in software engineering: component-based software engineering, model driven software development, the Agile paradigm including Extreme programming, software product lines engineering and community based software development such as Free and Open Source Software development.
- Appraise advanced software concepts and their applicability in practice: Design Patterns and Frameworks, Software Refactoring techniques, Software Architectural analysis, Software as a Service.

Syllabus

1. Analysis and improvement of software processes

Learners will be able to:

1.1 Explain and apply software process improvement.

Indicative content

a. For example:
   - CMM
   - CMM-I
   - SPICE (ISO/IEC 330XX)

b. ISO and IEEE Software Engineering standards, e.g.:
   - ISO 9001
   - ISO/IEC 12207
   - ISO/IEC 90003
   - IEEE 1012

Guidance

Candidates are expected to understand what software process improvement is. They should be familiar with one or more of the methods or frameworks identified here, and should be able to apply or recommend one of these frameworks to a given scenario.

1.2 Analyse and show understanding of software life cycle models.

Indicative content

a. Waterfall
b. V-model
c. Prototyping
d. Spiral model
e. Incremental development
f. Evolutionary development
g. Agile models, including extreme programming

Guidance

Candidates should be able to show knowledge of various software development lifecycle models, consider process lifecycles, and recommend a particular approach for a given scenario. They need to have an appreciation for the traditional as well as modern approaches, of which agile and extreme are examples.

1.3 Demonstrate knowledge and awareness of software requirements engineering.

Indicative content

a. Requirements management
b. Requirements elicitation

Guidance

Candidates should show awareness of the different stages of requirements engineering, and be able to outline and recommend different strategies of management for a given case study scenario. They should also demonstrate knowledge of the requirements elicitation process, and be able to evaluate and recommend appropriate tools and techniques for eliciting user requirements.

1.4 Demonstrate knowledge and awareness of software management.

Indicative content

a. Project management
b. Cost estimation
c. Planning
d. Personnel management
e. Team building

Guidance

Candidates should be able to demonstrate their knowledge of project management methods and techniques.

1.5 Demonstrate knowledge and awareness of the evolution of software.

Indicative content

a. Lehman's Laws of Software Evolution
b. Related models and studies

Guidance

Candidates are required to demonstrate their awareness of and possibilities for software measurement. This includes the theory, methods and techniques, and their strengths and weaknesses.

2. Analysis and improvement of software products

Learners will be able to:

2.1 Demonstrate awareness of and ability to apply software maintenance methods.

Indicative content

a. Impact Analysis
b. Reverse and re-engineering of software

Guidance

Candidates should show awareness of software maintenance and methods available and applicable to the engineer for a given case study scenario. Candidates are expected to apply and recommend appropriate methods for the scenario presented.

2.2 Analyse and explain software architecture and software refactoring.

Indicative content

a. Architectural styles, examples, and applications
b. Architectural models
c. Model-driven development

Guidance

Candidates are expected to demonstrate knowledge of various software architectures and evidence the strengths and weaknesses of different models in software development.

2.3 Evidence knowledge and awareness of software metrics.

Indicative content

a. Software complexity measures
b. Measures of software coupling and cohesion
c. Models and associated measures of software quality

Guidance

Candidates should evidence their knowledge of and their ability to use methods and techniques for measuring aspects of the software process and product.

3. Advanced topics in software engineering

Learners will be able to:

3.1 Evidence knowledge and awareness of the methods and techniques for software reuse.

Indicative content

a. Component based software engineering
b. Software product lines
c. Design patterns

Guidance

Candidates are expected to evidence their knowledge and awareness of the practice of software reuse, in particular the methods and the techniques available.

3.2 Analyse and explain software as a service.

Indicative content

a. Platform as a service
b. Infrastructure as a service, including:
   - Web services
   - Cloud computing
   - Dynamic reconfiguration of software systems

Guidance

Candidates are expected to evidence their knowledge and awareness of software as a service, in particular the methods and the techniques currently in use today.

3.3 Demonstrate knowledge and awareness of open-source software engineering practice.

Indicative content

a. Open-source software
b. Open-source development as a community
c. Strengths and weaknesses in comparison with proprietary-based development
d. Open source as good engineering practice

Guidance

Candidates are expected to demonstrate their knowledge and awareness of the practice of open-source development and efforts made to formulate as an engineering discipline.

3.4 Demonstrate knowledge and awareness of UML and its use.

Indicative content

a. Object-constraint language
b. Use of assertions
c. Pre- and post-condition
d. Invariants

Guidance

Candidates are expected to demonstrate knowledge of the object-constraint language and to be able to apply various constructs of assertion, pre- and post-conditions, and invariants, to a given software construction scenario.

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: Software Engineering (tenth edition)
Author: I. Somerville
Publisher: Pearson
Date: 2015
ISBN: 978-1292096131

Title: Software Engineering: A Practitioner's Approach (eighth edition)
Author: R. S. Pressman and B. Maxim
Publisher: McGraw-Hill Education
Date: 2014
ISBN: 978-1259253157

Additional Texts

Title: The Mythical Man-Month
Author: F. P. Brooks
Publisher: Addison-Wesley
Date: 1995
ISBN: 978-0201835953

Title: Software metrics: a rigorous and practical approach (third edition)
Author: N. Fenton and S. Pfleeger
Publisher: CRC Press
Date: 2015
ISBN: 978-1439838228

Title: Design Patterns: Elements of Reusable Object-Oriented Software
Author: E. Gamma, R. Helm, R. Johnson and J. Vlissides
Publisher: Addison-Wesley
Date: 1994
ISBN: 978-0201633610

Title: Managing the Software Process (SEI)
Author: H. Watts
Publisher: Addison-Wesley
Date: 1989
ISBN: 978-0201180954

Title: Code Quality: the Open Source Perspective
Author: D. Spinellis
Publisher: Addison-Wesley
Date: 2006
ISBN: 978-0321166074

Title: Extreme Programming Explained: Embrace Change (second edition)
Author: K. Beck
Publisher: Addison-Wesley
Date: 2004
ISBN: 978-0321166074

Title: Agile Software Development (second edition)
Author: A. Cockburn
Publisher: Addison-Wesley
Date: 2006
ISBN: 978-0321482754

Title: Software Architecture in Practice (SEI) (third edition)
Author: L. Bass, P. Clements and R. Kazman
Publisher: Addison-Wesley
Date: 2012
ISBN: 978-0321815736

Title: Requirements Engineering (third edition)
Author: E. Hull, K. Jackson and J. Dick
Publisher: Springer
Date: 2010
ISBN: 978-1849964043

Title: The Unified Modeling Language Reference Manual (second edition)
Author: J. Rumbaugh, I. Jacobson and G. Booch
Publisher: Addison-Wesley
Date: 2004
ISBN: 978-0321718952

Title: Software Evolution
Author: T. Mens and S. Demeyer
Publisher: Springer
Date: 2008
ISBN: 978-3540764397

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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 **July 2021**	Document Creation

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