

# BCS LEVEL 6 PROFESSIONAL GRADUATE DIPLOMA IN IT WEB ENGINEERING

## SYLLABUS



September 2021 v3.0

This qualification is regulated by one or more of the following:  
Ofqual, Qualifications Wales, CCEA Regulation or SQA.

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# Introduction

## Level 6 Professional Graduate Diploma in IT

The final stage within the BCS three-stage Higher Education Qualification program, 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.

## Web Engineering Optional Module

The Web Engineering 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 program.

Candidates will enhance their understanding of content development for the web and other emerging platforms. This module combines in-depth exploration of a number of key web technologies with a more strategic, high-level approach to web content's technological development. While the web is the module's core focus, candidates will gain an appreciation for other emerging media and an understanding of key issues related to development, dissemination and deployment. They will also identify, evaluate and apply appropriate technologies for web development and appreciate mechanisms for enriching web content, taking contextual factors into account.

# 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 applications or game development, web design or IT consultancy.

<b>Total Qualification Time</b>	<b>Guided Learning Hours</b>	<b>Assessment Time</b>
<b>1414 hours</b>	<b>250 hours</b>	<b>3 hours</b>

# SFIA Levels

This module 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.

## 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.

## EMRG4

Supports monitoring of the external environment and assessment of emerging technologies to evaluate the potential impacts, threats and opportunities to the organisation. Contributes to the creation of reports, technology roadmapping and the sharing of knowledge and insights.

## ICPM4

Maintains and updates content management processes to meet the needs of users including those with disabilities. Selects appropriate channels through which content should be published, providing advice to users and content authors to leverage the features of the relevant channels and tools used. Applies propriety guidelines and uses appropriate tools and techniques to provide publishing interfaces to new or existing platforms and applications. Identifies the implications of copyright, data protection and other legal issues associated with publishing.

Further detail regarding the SFIA Levels can be found at [www.bcs.org/levels](http://www.bcs.org/levels).

## SCTY4

Explains the purpose of and provides advice and guidance on the application and operation of elementary physical, procedural and technical security controls. Performs security risk, vulnerability assessments, and business impact analysis for medium complexity information systems. Investigates suspected attacks and manages security incidents. Uses forensics where appropriate.

## 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.

# Learning Outcomes

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

- Devise appropriate hosting and server strategies for websites in various application areas.
- Create and use of methods of web-based user interaction.
- Understand the use of basic metrics to assess software quality.
- Create test approaches and strategies.
- Evaluate and assess the security & privacy implications of web applications.
- Compare and contrast encryption mechanisms.
- Implement dynamic web pages.
- Use XML to enhance cross-application compatibility.
- Apply and manipulate the DOM using client-side scripting languages.
- Construct and reverse-engineer style sheets and XML documents.
- Demonstrate an appreciation of the issues in storing and retrieving data.
- Appreciate the social, ethical and legal considerations of the web.
- Appreciate the uses and technical limitations of syndication, streaming and collaborative authoring technologies.
- Demonstrate an appreciation of search and indexing algorithms.

# Syllabus

## 1. Strategies for web development

### Learners will be able to:

**1.1** Discuss options for hosting strategies.

#### Indicative content

- a. Domain registration
- b. Free versus commercial hosting solutions

#### Guidance

Candidates should have a good overview of the various strategies for web hosting and discuss the advantages and disadvantages of the proposed options.

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**1.2** Assess server/database replication.

#### Indicative content

- a. Backup and archiving
- b. RAID
- c. Bandwidth
- d. Availability

#### Guidance

Candidates should be able to assess the architectural requirements of systems that support web applications and demonstrate how they are constructed and managed to provide a secure and robust service environment.

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**1.3** Evaluate strategies for connecting databases to web applications.

#### Indicative content

- a. Strategies for connecting databases to web applications safely and securely
- b. Connection pooling

#### Guidance

Candidates need to fully understand the importance of being able to interface databases with web applications safely and securely, and propose appropriate solutions for various scenarios.

## 2. Programming for the web

### Learners will be able to:

**2.1** Evaluate methods of interaction between browser and server.

#### Indicative content

- a. HTML forms
- b. Client-Server model.

#### Guidance

Candidates should understand the client-server model and how it can be used to control the interaction between browser and server.

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**2.2** Assess ways of controlling access to web resources.

#### Indicative content

- a. Limiting access with htaccess and htpasswd configuration files

#### Guidance

Candidates should understand the various mechanisms for controlling access to web resources and assess which are appropriate in various scenarios.



**2.3** Discuss how to develop dynamic content.

### **Indicative content**

- a. Using Client-Server architecture
- b. Representational State Transfer (REST) architecture
- c. JavaScript and Java

### **Guidance**

Candidates should have an understanding of standards and languages for developing dynamic content and be able to discuss which are appropriate in various situations.

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**2.4** Demonstrate the development of dynamic content using PHP or similar dynamic content tools.

### **Indicative content**

- a. Interfacing with a database
- b. Limited knowledge of SQL syntax is required to allow iterating over a data set

### **Guidance**

Candidates should be able to use a current dynamic content tool such as PHP, although other tools are acceptable. Furthermore, they should understand the basic methods of interfacing a web application with a database, including the use of SQL.

NB: The use of JSP, JSF, ASP or Perl is equally acceptable for this module.

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**2.5** Explain validating user input.

### **Indicative content**

- a. Simple pattern matching

### **Guidance**

Candidates should understand methods of validating user input and why this is necessary.

## 3. XML and CSS

### Learners will be able to:

**3.1** Demonstrate application of XML.

#### Indicative content

- a. XML
- b. XHTML 1.0 Transitional/Strict
- c. XSLT
- d. DTD
- e. CSS (1 and 2)

#### Guidance

Candidates should demonstrate an understanding of eXtensible Markup Language (XML), including how it relates to HTML. They should also demonstrate the ability to develop appropriate code for a given scenario.

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**3.2** Demonstrate how the structure of an XML document can be assessed.

#### Indicative content

- a. Well formedness
- b. Validity

#### Guidance

Candidates should understand that validity relates to semantics and well-formedness to syntax. Candidates should be able to demonstrate that valid XML can be constructed by associating a DTD with it and verifying it against all the rules contained in the DTD in addition to it being well-formed.

## 4. Security and privacy

### Learners will be able to:

**4.1** Assess the typical risks with attacks.

#### Indicative content

- a. Typical risks of attack
- b. Identifying risks
- c. Preventing risks
- d. Mitigating against risks

#### Guidance

Candidates should have an understanding of a range of typical risks and attacks that a web application may be subject to. They should understand a range of strategies for mitigation and prevention.

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**4.2** Discuss the differences between integrity and authentication.

#### Indicative content

- a. Integrity
- b. Authentication
- c. Non-repudiation

#### Guidance

Candidates should understand the need for integrity, authorisation and non-repudiation and how to assess the methods to use in a particular application.

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**4.3** Demonstrate the ability to assess and deploy both public and private key encryption.

#### Indicative content

- a. Ability to assess and deploy:
  - i. Public and private key encryption
  - ii. On-the-fly encryption
  - iii. Hashes
  - iv. Uses and limitations of RSA, DES and AES etc

#### Guidance

Candidates should be able to assess the need for the use of and the advantages and limitations of various encryption methods, and the difference between public and private keys.

**4.4** Explain the use of methods to enhance safety and security.

### **Indicative content**

- a. Use of Digital Certificates
- b. HTTPS
- c. Steganography
- d. Biometrics
- e. Two-stage authentication

### **Guidance**

Candidates should be able to assess a range of methods to improve safety and security, demonstrate how they may be implemented in particular circumstances, and assess the potential for them to be circumvented.

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**4.5** Identify attacks and how to protect against them.

### **Indicative content**

- a. Phishing
- b. Web profiling
- c. Internet anonymity
- d. Identity theft

### **Guidance**

Candidates should be able to assess a range of typical attack methods and strategies for protecting against them.

## 5. Quality

### Learners will be able to:

**5.1** Evaluate testing approaches.

#### Indicative content

- a. Functional testing
- b. Compatibility testing
- c. Usability testing
- d. Interface testing
- e. Security testing
- f. Load/performance testing
- g. Other forms of non-functional testing and maintenance

#### Guidance

Candidates should be able to evaluate the appropriateness of the main approaches to testing web applications and demonstrate the ability to develop a coherent test strategy for a particular implementation.

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**5.2** Evaluate characteristics of quality.

#### Indicative content

- a. ISO/IEC 25010:2011

#### Guidance

Candidates should be aware of quality standards and organisations and how to apply them in specific situations.

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**5.3** Assess the use of metrics in quality.

#### Indicative content

- a. Availability
- b. Performance
- c. Reliability
- d. Accuracy
- e. Compliance with standards
- f. Integration
- g. Maintainability
- h. Testability

#### Guidance

Candidates should demonstrate a clear understanding a range of metrics for measuring the quality of a web application and how to apply them.

**5.4** Discuss quality of service (QoS).

### **Indicative content**

- a. Functional and non-functional aspects of QoS, e.g.:
  - i. Performance
  - ii. Reliability
  - iii. Integrity
  - iv. Accessibility
  - v. Availability
  - vi. Interoperability
  - vii. Security

### **Guidance**

Candidates should understand why QoS is important and the measures used to manage it including for example the effect of packet loss, jitter, latency.

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**5.5** Evaluate standards and conformity.

### **Indicative content**

- a. W3C
- b. WAI
- c. CSS

### **Guidance**

Candidates should be able to discuss the role of W3C in setting standards, and its initiatives, such as web accessibility initiative (WAI).

## 6. Social and ethical issues

### Learners will be able to:

**6.1** Evaluate the impact of technologies.

#### Indicative content

- a. Social and ethical impact of technologies for controlling Web access

#### Guidance

Candidates should understand a range of measures for controlling web access and their social and ethical impact.

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**6.2** Assess the consequences of media convergence.

#### Indicative content

- a. Social consequences
- b. Commercial consequences

#### Guidance

Candidates should demonstrate an awareness of the convergence of various media, e.g. online newspapers and evaluate the social and ethical consequences of such developments.

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**6.3** Evaluate the social and economic impact of e-commerce.

#### Indicative content

- a. Online shopping
- b. Online banking
- c. Online auctions, etc.

#### Guidance

Candidates should be aware of a range of current e-commerce web applications and be able to evaluate their social and economic impact.

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**6.4** Discuss the ethical and economic implications of accessibility.

#### Indicative content

- a. Ethical and economic implications of accessibility policies and legislation

#### Guidance

Candidates should be aware of the importance of compliance with accessibility standards and legislation and discuss how they can be applied in practice.

## 7. Emerging technologies and platforms

### Learners will be able to:

**7.1** Discuss the use of emerging web technologies.

#### Indicative content

- a. Current developments, e.g.:
  - i. Streaming media
  - ii. RSS
  - iii. IRC
  - iv. Wiki
  - v. Blog
  - vi. Web Forum
  - vii. Portals

#### Guidance

Candidates should be able to discuss a range of the latest emerging technologies and assess their impact.

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**7.2** Evaluate the use of online connectivity.

#### Indicative content

- a. Systems that make use of online connectivity, e.g.:
  - i. Personal digital assistants (PDAs)
  - ii. Games consoles
  - iii. Mobile phones
  - iv. Apps
  - v. Blog
  - vi. Web Forum
  - vii. Portals

#### Guidance

Candidates should be able to evaluate the impact of enhanced connectivity on various devices and applications, and assess their impact both technically and socially.

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**7.3** Discuss and evaluate the use of social networks.

#### Indicative content

- a. Social networks, including:
  - i. Linking
  - ii. Customisation

#### Guidance

Candidates should be able to discuss a range of social media and understand their impact.

# Examination Format

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

<b>Type</b>	Three written questions from a choice of five, each with equal marks
<b>Duration</b>	Three hours
<b>Supervised</b>	Yes
<b>Open Book</b>	No (no materials can be taken into the examination room)
<b>Passmark</b>	10/25 (40%)
<b>Delivery</b>	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:** Web Programming: Building Internet Applications  
**Author:** C. Bates  
**Publisher:** Wiley  
**Date:** 2006  
**ISBN:** 978-0470017753

**Title:** Web Security, Privacy and Commerce  
**Author:** S. Garfinkel and G. Spafford  
**Publisher:** O'Reilly  
**Date:** 2001  
**ISBN:** 978-0596000455

**Title:** Client-Server Web Apps with JavaScript and Java  
**Author:** C. Saternos  
**Publisher:** O'Reilly  
**Date:** 2014  
**ISBN:** 978-1449369330

**Title:** Relevant Search With Applications for Solr and Elasticsearch  
**Author:** D. Turnbull and J. Berryman  
**Publisher:** Manning  
**Date:** 2014  
**ISBN:** 978-1617292774

**Title:** PHP Web Services: APIs for the Modern Web  
**Author:** L. J. Mitchell  
**Publisher:** O'Reilly  
**Date:** 2016  
**ISBN:** 978-1491933091

**Title:** The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws  
**Author:** D. Stuttard and M. Pinto  
**Publisher:** O'Reilly  
**Date:** 2011  
**ISBN:** 978-1118026472

## Additional texts

**Title:** Secrets and Lies: Digital Security in a Networked World  
**Author:** B. Schneier  
**Publisher:** Wiley  
**Date:** 2004  
**ISBN:** 978-0471453802

## Online resources

**Title:** Making the Web Accessible

**Organisation:** World Wide Web Consortium (W3C)

**Available at:** <https://www.w3.org/WAI/> [Accessed 14 July 2021]

**Title:** Extensible Markup Language (XML)

**Organisation:** World Wide Web Consortium (W3C)

**Available at:** <https://www.w3.org/XML/> [Accessed 14 July 2021]

**Title:** Platform for Internet Content Selection (PICS)

**Organisation:** World Wide Web Consortium (W3C)

**Available at:** <https://www.w3.org/PICS/> [Accessed 14 July 2021]

**Title:** PHP: Hypertext Preprocessor

**Organisation:** PHP.net

**Available at:** <https://www.php.net/> [Accessed 14 July 2021]

# 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.

<b>Version Number</b>	<b>Changes Made</b>
<b>Version 1.0</b> <b>August 2021</b>	Document created

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