BCS LEVEL 5 DIPLOMA IN IT

WEB APPLICATION DEVELOPMENT

SYLLABUS

THIS QUALIFICATION WILL BE RETIRING IN 2026

September 2023 v1.1

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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.

Web Application Development Optional Module

The Web Application Development 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 explore mark-up languages, various web technologies, development methods, as well as front- and back-end technologies. Candidates will also consider the social, legal, ethical and professional issues relating to web applications.

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 game development, multimedia programming, or web design.

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.

ICPM3

Coordinates content management processes to meet the needs of users, including those with disabilities. Uses content publishing systems to manage published content across different channels. Takes into account any legal issues related to publishing, including that associated copyright concerns are adequately managed.

PROG3

Designs, codes, verifies, tests, documents, amends and refactors moderately complex programs/scripts. Applies agreed standards and tools, to achieve a well-engineered result. Collaborates in reviews of work with others as appropriate.

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.

TEST3

Reviews requirements and specifications, and defines test conditions. Designs test cases and test scripts under own direction, mapping back to pre-determined criteria, recording and reporting outcomes. Analyses and reports test activities and results. Identifies and reports issues and risks associated with own work.

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:

- Evaluate the contribution of underpinning web technologies to the process of web application development.
- Apply the procedures and processes necessary for the construction of high-quality web applications.
- Compare and contrast a variety of front end and back end web application frameworks.
- Apply a range of testing strategies and techniques to quality assure and continuously monitor web applications.
- Appreciate the importance of legal, social, ethical and professional issues associated with web applications.

Syllabus

1. Assess the technologies that are appropriate to build a web application

Learners will be able to:

1.1 Describe, compare and contrast mark-up languages.

Indicative content

a. XML and HTML
b. Document Object Model (DOM)
c. CSS Object Model (CSSOM)
d. Interchange languages:
   i. XML
   ii. JSON
   iii. YAML
e. Web protocols:
   i. HTTP
   ii. HTTPS
f. Interface description languages:
   i. WSDL
   ii. Thrift
g. Style sheet languages:
   i. XSL
   ii. CSS

Guidance

Candidates will be expected to be able to discuss different mark-up languages and interchange models, as well as be able t use them. Candidates are expected to be able to assess the appropriateness of each language for a given application.

1.2 Discuss standards and web technologies.

Indicative content

a. W3C
b. ISO
c. ECMA International
d. ISO
e. IETF
f. IANA
g. WHATWG
h. Evolution of web technologies:
   i. Web 1.0
   ii. Web 2.0
   ii. Web 3.0/Semantic Web

Guidance

There are many standards associated with web technologies. Candidates will be expected to be able to identify the appropriate international standards and be able to apply them to their own applications.

1.3 Explain browsers and internet technology.

Indicative content

a. Browsers
b. Web servers
c. Application servers
d. Mobile web

Guidance

A web application is built from a number of components. Candidates will be expected to describe them and explain their role in a typical web application system.

1.4 Discuss framework architectures.

Indicative content

a. MVC
b. MVVM
c. Flux
d. MVA
e. MVP
f. Push vs pull
g. Multi-layer

Guidance

Candidates will be expected to understand appropriate framework architectures and appreciate their use.

2. Apply appropriate development methods to build web applications

Learners will be able to:

2.1 Explain stake holder analysis.

Indicative content

a. Requirements analysis
b. The double diamond model
c. INVEST

Guidance

Candidates will be expected to demonstrate an understanding of why requirements analysis is required, and the tools available to assist the developer.

2.2 Discuss project management techniques and tools.

Indicative content

a. Project stages:
   i. Initiation
   ii. Planning
   iii. Execution
   iv. Monitoring
   v. Closure
b. Team collaboration tools
b. Scheduling and planning
b. Budget management

Guidance

Effective project management is essential for projects to be delivered on budget and on time. Candidates will be expected to explain the stages in a project and the tools available to help them plan, schedule and budget it effectively.

2.3 Compare agile software engineering methods.

Indicative content

a. Scrum and Kanban
b. Hypothesis driven development

Guidance

Agile software engineering methods are becoming much more popular, and are considered more appropriate than traditional methods. Candidates should be able to discuss and compare the popular methods and demonstrate how they are applied.

2.4 Compare the roles of members of web application development teams.

Indicative content

a. Project manager
b. Project architect
c. UI/UX designers
d. Front-end developers
e. Back-end developers
f. Database developers
g. QA and testing specialists

Guidance

A project team requires many different skills if it is to successfully complete its task. Candidates will be expected to compare these roles and explain how they need to work together as an effective team to produce a successful outcome.

2.5 Discuss what is meant by version control.

Indicative content

a. E.g. (but not limited to):
   - GitHub
   - GitLab
   - Beanstalk
   - PerForce
   - Apache Subversion

Guidance

Managing software development requires effective monitoring of progress and ensuring that team members are working on the most recent and appropriate versions available. If it is necessary to branch, then each branch should be tracked and the reintegration process managed. Candidates will be expected to be able to discuss the main issues associated with version control, and discuss the tools available to help them manage it.

2.6 Compare the roles of front-end and back-end technologies.

Indicative content

a. The difference in roles of the front and back ends, including:
   - Client-server
   - Peer-to-peer
   - How developers decide to locate particular functionalities

Guidance

Candidates will be expected to discuss the roles of the front end and back end of web applications, architectures used for their implementation and determine how the functionality should be split between them.

3. Front-end technologies

Learners will be able to:

3.1 Explain and demonstrate key functions of JavaScript language.

Indicative content

a. Javascript/ECMAScript:
   i. Statements
   ii. Expressions
   iii. Identifiers
   iv. Primitive values
   v. Objects
   vi. Properties
   vii. Operators
   viii. Conditionals
   ix. Loops
   x. Functions
   xi. Exception handling
   xii. Arrays
   xiii. Regular expressions
b. HTML events

Guidance

Many web applications use JavaScript to modify what is displayed in the browser without reloading the complete pare. Candidates will be expected to explain its use and relationship with other front end languages and technologies and demonstrate how it is used with practical examples.

3.2 Explain and demonstrate jQuery methods.

Indicative content

a. Content Delivery Networks
b. Document ready event
c. Selectors
d. Event methods
e. Effects
f. Call-back functions
g. Chaining
h. Get content
i. Set content

Guidance

Candidates will be expected to be able to discuss the role of Contact Delivery Networks and the tools used to implement them in practice.

3.3 Demonstrate CSS pre-processing.

Indicative content

a. Sass
b. Less
c. Stylus

Guidance

Candidates will be expected to discuss the role of CSS processing and how it helps developers build effective web sites, as well as demonstrate how it is used.

3.4 Demonstrate front-end frameworks.

Indicative content

a. E.g. (but not limited to):
   i. Backbone.js
   ii. AngularJS
   iii. Angular
   iv. EmberJS
   v. ReactJS
   vi. Vue.js

Guidance

Frameworks are used to speed development and provide consistency to web applications. Candidates should be able to discuss their properties and demonstrate examples of their use.

3.5 Explain object-relational mapping.

Indicative content	Guidance
a. AJAX: i. XMLHttpRequest object ii. GET and POST iii. Synchronous and asynchronous requests iv. Server responses	As web applications become more complex, the interaction between the client and the server become more critical to the achievement of their goals. Candidates will be expected to discuss the various means by which clients and servers can interact, and assess which to use in particular circumstances.

4. Back-end technologies

Learners will be able to:

4.1 Discuss the different options for information storage in web applications.

Indicative content	Guidance
a. SQL vs NOSQL b. Key-value stores c. Document stores d. Graph databases e. Brewers CAP theorem f. ACID and eventually consistent transactions	There are an increasing range of potential information storage methods. Candidates should be able to identify the most appropriate for a particular task, and demonstrate how they would implement such a solution.

4.2 Discuss types of architecture that can be used to build web applications.

Indicative content	Guidance
a. Service oriented architecture b. Microservices	Candidates should be able to compare service orientated and microservices architecture discuss the advantages and disadvantages of each.

4.3 Discuss the tools that are used when developing back-ends.

Indicative content	Guidance
a. APIS: i. REST methods ii. HATEOAS methods iii. HTTP methods d. Event based APIs e. WebSockets f. Error handling g. Caching	Candidates should be able to discuss a range of tools used to develop back end technologies, including their advantages and disadvantages.

4.4 Discuss the key features of back end technologies.

Indicative content	Guidance
a. Language b. Architecture c. Cost d. Scalability	Candidates should be able to discuss a range of back end technologies, including their advantages and disadvantages.

4.5 Discuss the role and use of back end frameworks.

Indicative content	Guidance
a. E.g. (but not limited to): i. Django ii. Rails iii. Spring iv. Flask v. Laravel	There are various frameworks that assist the developer in constructing the back end of web applications. Candidates should be able to discuss their role in the application building process, and the criteria for choosing which is appropriate for a particular development.

5. Testing and evaluation

Learners will be able to:

5.1 Discuss the roles of available testing methods.

Indicative content	Guidance
a. Property-based testing b. Unit testing c. Integration testing d. End-to-end testing e. Manual testing f. Visual testing g. Cross-functional testing h. Load testing	Each testing method is designed to identify errors at various stages in the development process. Candidates should be able to identify the range of testing methods available, how each is performed and their role in the development process.

5.2 Explain test-orientated development methods.

Indicative content	Guidance
a. E.g. (but not limited to): • Test-driven development • Behaviour-driven development	Candidates should be able to explain what is meant by different types of test development methods, including the stages in the development process and their advantages and disadvantages.

5.3 Describe testing frameworks.

Indicative content	Guidance
a. Frameworks and tools, e.g. (but not limited to): • Cucumber • Selenium • JIRA • Bugzilla • JMeter	Tools are important in ensuring that tests are carried out thoroughly and properly recorded. Candidates should be able to discuss a range of available testing frameworks and describe how they are used.

5.4 Explain web analytics.

Indicative content	Guidance
a. Logfile analysis b. Page tagging c. Click analytics d. Customer lifecycle analytics	Analytics are used both to identify issues with the execution of web applications and to track and assess visitor activity (both individually and as a whole). Candidates should be able to describe the range of analytical data available and explain how it can be used to assist the web applications designer.

6. Social, legal, ethical and professional issues

Learners will be able to:

6.1 Discuss the different options for information storage in web applications.

Indicative content	Guidance
a. E.g. (but not limited to): i. National and international data protection regulations	Most countries have adopted the international standards ISO27001 for data security and ISO27701 for data privacy but most have modified them for their own needs, as for example the GDPR regulations in Europe. Candidates shall be expected to understand the need for such regulations and compare the requirements in the different jurisdictions in which they expect to work.

6.2 Discuss web application security.

Indicative content	Guidance
a. Secrets and trust b. Threats	All web sites are subject to a range of security issues. Failure to properly protect the information held will lead to a lack of trust and potential visitors will be unwilling to visit. Candidates will be expected to identify and categorise these threats and discuss how they would attempt to protect a site against them by for example implementing an Information Security Management System (ISMS).

6.3 Explain privacy issues in web applications.

Indicative content	Guidance
a. Validation and sanitisation b. Threats c. OWASP top ten vulnerabilities	If website visitors are to have confidence in an application, they must be assured that the information that they provide will be held privately and only for the purpose which it was given. Candidates should be able to explain the privacy requirements specified by ISO 27701, GDPR and local legislation, where appropriate.

6.4 Explain interface design and accessibility.

Indicative content	Guidance
a. Web content accessibility guidelines b. Screen reader testing	It is important that web applications are made fully accessible so that they can be used effectively by everybody. It is therefore essential that development teams fully understand the requirements of every type of user. The Web Content Accessibility Guidelines (WCAG) have been developed to assist developers in achieving this. Candidates should be able to discuss the design principles and their implementation. They should also be able to plan and execute the steps necessary to ensure that their application is fully available through a screen reader.

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 and resources

Title: Ry's Git Tutorial
Author: R. Hodson
Publisher: RyPress
Date: 2014
Available at: https://www.amazon.co.uk/Rys-Git-Tutorial-Ryan-Hodson-ebook/dp/B00QFIA5OC [Accessed 09 July 2021]

Title: The full stack developer: your essential guide to the everyday skills expected of a modern full stack Web developer
Author: C. Northwood
Publisher: Apress
Date: 2019
ISBN: 978-1484241516

Title: OWASP Top Ten
Author: OWASP
Creation Date: 2017
Available at: https://owasp.org/www-project-top-ten/ [Accessed 09 July 2021]
ISBN: 978-1118804674

Additional texts and resources

Title: Web Accessibility: Web Standards and Regulatory Compliance
Author: M. R. Burks, et al
Publisher: Apress
Date: 2006
ISBN: 978-1590596388

Title: Agile testing: a practical guide for testers and agile teams.
Author: L. Crispin and J. Gregory
Publisher: Addison Wesley
Date: 2009
ISBN: 978-0321534460

Title: Web Design with HTML, CSS, JavaScript and jQuery
Author: J. Duckett
Publisher: Wiley
Date: 2014
ISBN: 978-1118907443

Title: Continuous integration: improving software quality and reducing risk
Author: P. M. Duvall, S. Matyas and A. Glover
Publisher: Addison Wesley
Date: 2007
ISBN: 978-0321336385

Title: How the Double Diamond process can help you work in a more user-centred way
Author: Author: C. Eissa
Date: 2019
Available at: https://www.testingtime.com/en/blog/double-diamond-process/ [Accessed 09 July 2021]

Title: Just jQuery: Events, Async & AJAX
Author: I. Elliot
Publisher: I/O Press
Date: 2017
ISBN: 978-1871962529

Title: Service-Oriented Architecture: Concepts, Technology, and Design (second edition)
Author: T. Erl
Publisher: Prentice Hall
Date: 2015
ISBN: 978-0133858587

Title: Enterprise integration patterns: designing, building, and deploying messaging solutions
Author: G. Hohpe and B. Woolf
Publisher: Addison Wesley
Date: 2004
ISBN: 978-0321200686

Title: Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity
Author: A. Kaushik
Publisher: Sybex
Date: 2009
ISBN: 978-0470529393

Title: Kanban and Scrum: making the most of both
Author: H. Kniberg and M. Skarin
Publisher: C4Media
Date: 2010
ISBN: 978-0557138326

Title: Javascript & jquery: The Missing Manual (third edition)
Author: D. S. McFarland
Publisher: O'Reilly Media
Date: 2014
ISBN: 978-1491947074

Title: Building microservices: designing fine-grained systems
Author: Author: S. Newman
Publisher: Publisher: O'Reilly Media
Date: Publication Date: 2015
ISBN: ISBN: 978-1491950357

Title: Speaking JavaScript
Author: A. Rauschmayer
Publisher: O'Reilly Media
Date: 2014
ISBN: 978-1449365035

Title: RESTful Web APIs. RESTful Web application programming interfaces
Author: L. Richardson, M. Amundsen and S. Ruby
Publisher: O'Reilly Media
Date: 2013
ISBN: 978-1449358068

Title: Essential Scrum: a practical guide to the most popular agile process
Author: K. S. Rubin
Publisher: Publisher: Addison Wesley
Date: Publication Date: 2012
ISBN: 978-0137043293

Title: NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence
Author: P. J. Sadalage
Publisher: Addison Wesley
Date: 2013
ISBN: 978-0321826626

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

Title: Constructing accessible web sites
Author: J. Thatcher
Publisher: Apress
Date: 2002
ISBN: 978-1590591482

Title: INVEST in Good Stories, and SMART Tasks
Author: W. Wake
Publisher: Apress
Date: 2003
Available at: https://xp123.com/articles/invest-in-good-stories-and-smart-tasks/ [Accessed 09 July 2021]

Title: REST in practice: Hypermedia and Systems Architecture
Author: J. Webber, S. Parastatidis and I. Robinson
Publisher: O'Reilly Media
Date: 2010
ISBN: 978-0596805821

Title: The Tangled Web : A Guide to Securing Modern Web Applications.
Author: M. Zalewski
Publisher: Penguin Random House
Date: 2012
ISBN: 978-1593273880

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

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