Pearson BTEC

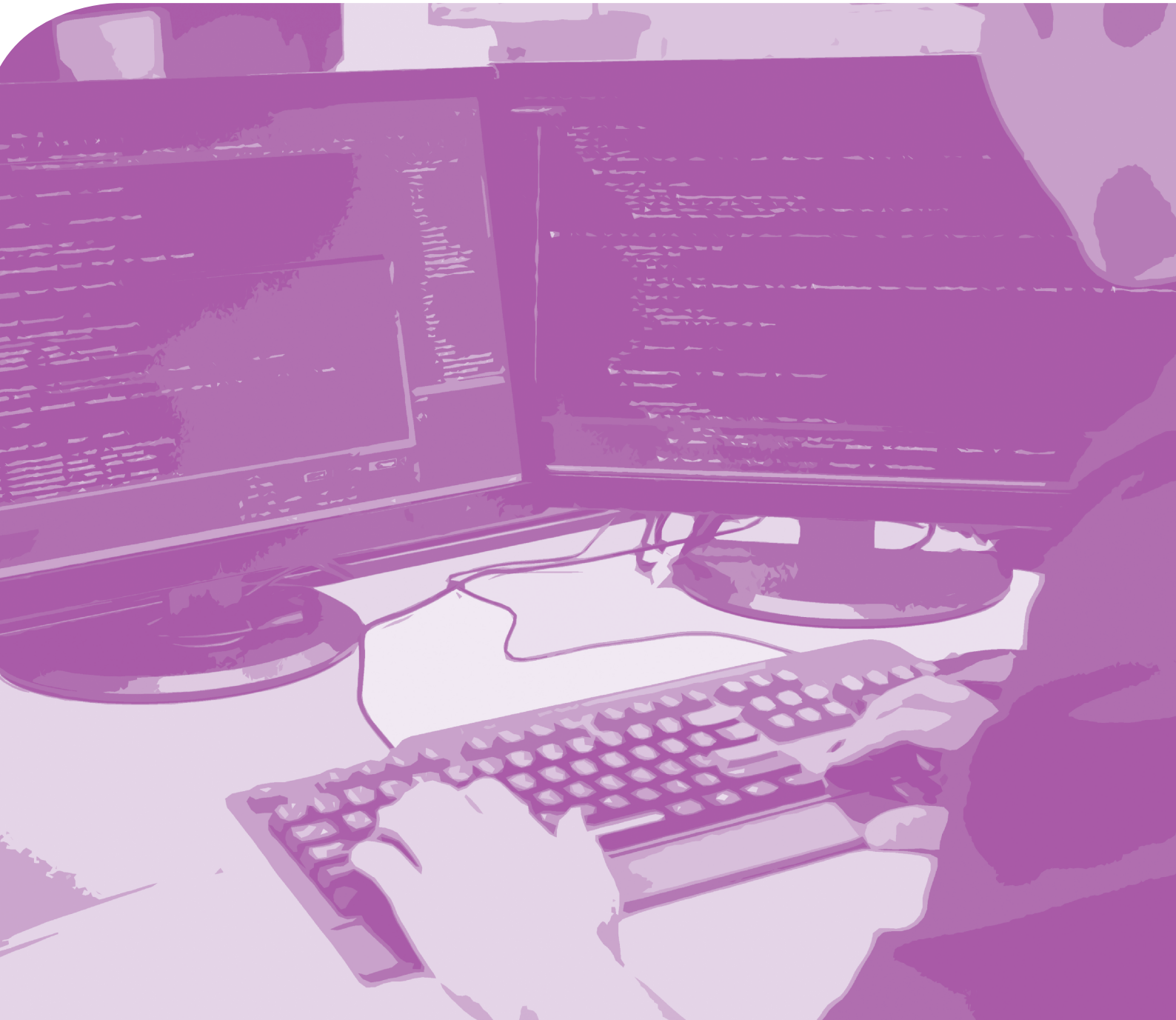
Pearson BTEC Uzbekistan Level 4 Qualifications in

Software Development

Unit 5: Database Development for Web Applications

Teacher Resources

Issue 1



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Contents

Introduction

This resource booklet is a companion to the BTEC Uzbekistan Level 4 Qualifications in Software Development. The specification tells you what must be taught and what must be assessed. This resource booklet gives you suggestions and ideas as to how you can do this.

This booklet gives you ideas for teaching and learning, including practical activities, realistic scenarios, ways of involving employers in delivery and of managing independent learning, and how to approach assessments. The booklet also shows you how the specification content might work in practice and inspires you to start thinking about different ways of delivering your qualification.

This resource booklet gives you:

- guidance on how to deliver the unit
- recommended resources to support the delivery of the unit
- a scheme of work that show the topics, activities and assessments covered in the unit
- lesson plans with detailed guidance on how to deliver the lessons in the unit

The information in this resource booklet has been put together by teachers who have been close to the development of the qualification and so understand the challenges of finding new and engaging ways to deliver BTEC qualifications.

The delivery guidance in this booklet gives you information on what you need to consider as you plan the delivery of the unit. This includes suggestions on how to approach the learning aims and unit content, as well as ideas for interesting and varied activities. You will also find tips and ideas on how to plan for and deliver your assessments.

We have included a list of carefully selected resources for the unit. This resource list offers suggestions for books, websites and videos that you can direct your learners to use and/or that you can use to complement delivery.

Unit 5: Database Development for Web Applications

Delivery guidance

Approaching the unit

The unit allows learners to understand the principles of creating web applications that meet client requirements. It focuses on the design, development testing and review of such applications.

Learners should have access to software resources that will allow them to use the tool and techniques (give in the unit content) to design, develop, test and review web applications. Front-end examples include (HTML, CSS, JavaScript), Bootstrap, etc. Back-end examples include suitable operating system, web server, database, programming language and, possibly, a web development framework.

A range of scenarios and datasets should be developed by the teacher. These will be used by learners to develop their skills in the build-up to assessment. Activity sheets should also be developed based upon these scenarios and datasets, for example, queries that need to be produced.

It is best for the delivery of Learning aims A and B to be integrated in the way described below.

For Learning aim A, learners should begin by focusing on the relational database. They should study the scenarios and datasets in order to obtain a lot of practice of relational database modelling. Learners should only move forward to database structure design once they are confident with producing the documentation associated with relational database modelling. For database structure design, learners should produce table designs for each scenario based upon their database modelling.

Once learners are confident with database structure design, they should move on to Learning aim B practising the creation of databases and using SQL to manipulate data. Learners will move back to Learning aim A once they are fully confident with relational databases.

Front-end design should be the next aspect to focus upon. Learners will already be aware of, and have created, front-end designs in Unit 3. This unit builds upon that with learners also designing front-end validation and verification routines. These are over and above validation routines built into

the database. Learners will use algorithms to describe these routines. They will also learn how to specify the design of SQL.

Learners will also consider security methods that can be used when building web applications. At this level, it is not an absolute requirement that the methods have to be incorporated into their web application, however, they must be aware of the methods and indicate, in their designs, where and how they would be used.

For Learning aim B, as previously mentioned, building the relational database and using SQL to manipulate data will have been mastered before all of Learning aim A has been completed. Once Learning aim A has been fully completed, learners will move on to developing their skills in using a script-based programming language. Learners must become comfortable in using the language prior to any interaction with the database.

Once learners are comfortable with using the scripting language it is time to develop the front-end of the web application based upon their page designs. Learners will already have mastered the skills of using CSS, HTML and JavaScript in Unit 3. They will build upon this to incorporate interaction between the front-end and the back-end database as per their designs.

For Leaning Aim C, ensure that learners are aware of the need for robust and reliable web applications and the role that testing plays in this. Encourage learners to test as they go and explain that an iterative approach to development leads to much higher quality outcomes. However, it is only the final stage of testing that needs to be documented. Learners will use the testing template in order to produce a test plan to carry out and document functionality testing.

For Learning aim D, teachers should ensure that learners have access to examples of user guides and technical guides and that they fully understand they are for different audiences. They should produce at least one user and one technical guide prior to assessment.

For Learning aim E, teachers should encourage peer reviewing and feedback during the development of the practice web applications. This will allow learners to hone their skills in terms of determining whether a web application meets client requirements or not. They should also be given the opportunity to produce at least one practice review prior to assessment.

Remember to give learners appropriate feedback throughout the course. Provide learners with opportunities to read and understand feedback given and encourage them to take initiative to identify areas of development.

Getting started

This gives you a starting place for one way of delivering the unit. It is based on the recommended assessment approach given in the specification.

Unit 5: Database Development for Web Applications
Introduction Web applications are used by many businesses in order to manage the transactions between themselves and their target audience. However, transactions are only effective if the business can securely capture and store the necessary data, process it and effectively present the results to the user. Server-side scripts can be used to handle the storage and retrieval of information that resides in a relational database whilst client-side scripts (JavaScript and HTML) can be used to present information to users. This combination allows users to interact with a business e.g. online forms, content management systems, shopping carts and more. This unit focuses on relational databases, server-side technologies and how server-side scripting can be used to create web-based applications. Learners will learn about choosing an appropriate technology stack from which a web application can be built, the difference between front-end and back-end design and development, how to carry out and document functionality testing and how to review the design and final web application in terms of how well the client needs have been met
Learning aim A – Design a secure web application that uses a relational database to meet client requirements
Teachers should produce a number of scenarios and datasets that can be used throughout the unit prior to assessment. This will ensure that learners are familiar with designing and developing web applications based upon them prior to beginning assessment. Learning aim A can be broken down into stages. 1. Relational database design This is a topic that learners will not have come across in any of the other units. It should be approached in a linear fashion – initial ERD modelling based upon the scenario, normalisation of the data set, combination of the two to arrive at the final ERD. Learners work in pairs/small groups to produce all three forms of documentation for the scenarios and datasets produced by the teacher. The documentation can be found in Assessment Workbook. They should retain this documentation as any design work will be based upon them. Once they have completed the design for all scenarios, they should move on to Learning aim B to

Unit 5: Database Development for Web Applications
master the development of a relational database before coming back to master the skills required in the rest of Learning aim A. 2. Front-end design Learners will have completed building the relational databases before coming back to Learning aim A. Teachers should now recap how to produce page designs. Learners will already be familiar with them and will have produced them in Unit 3. Learners should practice produce page designs, using the documentation in the Assessment Workbook, for each of the scenarios they have built a database for. 3. Front and back-end interaction design Teachers should then introduce server-side validation and verification and give examples of how they can be designed using algorithms (flowcharts and pseudocode). Learners will determine appropriate routines for the scenarios and produce algorithms using either flowcharts, pseudocode of a mixture of both. Teachers should then explain and demonstrate to learners how to include SQL in their designs. Learners will already have good experience of using SQL at this point so should be able to write SQL statements, though at this level they may include written English too. Learners need to be aware of securing data and the various methods that can be used in order to do this. In terms of design they must specify what security methods should be considered and how they could be incorporated. They do not necessarily need to go on and include these when they develop the web application, e.g. prepared statements. Scenarios should include a wide range of interaction. For example, the need to add new records, edit records, delete records, query single and multiple tables, display single and multiple records, using select, aggregate queries, etc. They will provide learners with the best opportunity to be able to design this interaction.
Learning aim B – Develop a secure web application that uses a relational database to meet client requirements
Learning aim B can also be broken down into stages. 1. Development of a relational database Once learners have completed their relational database designs for all of the scenarios they should be introduced to building and querying relational databases. They should build a relational database for each of the designs they have produced. These should include a range of different data types and validation. There should also be many opportunities to practice querying the database prior to having to incorporate it using a server-side scripting language. Once this stage is complete, learners should move back to Learning aim A.

Unit 5: Database Development for Web Applications
2. Development of the front-end Learners should develop the front-end of a web application for each of the scenarios. They should already possess skills that allow them to do this. Teachers should recap those skills. Development of the front-end does not include interaction with the back-end. 3. Development of front and back-end interaction As previously mentioned, the scenarios should include the need to add new records, edit records, delete records, query single and multiple tables, display single and multiple records, using select, aggregate queries, etc. They should also provide opportunities for learners to practice validation and verification techniques. This gives learners the opportunity to become comfortable with programming such interaction.
Learning aim C – Carry out functionality testing of a web application that uses a relational database
Learners will have already learned and practiced testing systems. They will have done this in Units 1, 2 and 4. Teachers should recap the importance of testing and how to complete a test plan. Learners should be given the opportunity to carry out functionality testing for at least one of the web applications they have built prior to assessment.
Learning aim D – Produce user and technical documentation for a web application that uses a relational database
Teachers should ensure learners have a range of user and technical guides to explore. They should emphasise the importance of each and that they are for different audiences. Teachers should ensure that learners are given the opportunity to develop their presentation skills, e.g. setting up a house style, using automated contents pages and heading styles, automatic page numbering, etc. Learners should have the opportunity to produce at least one of each guide before assessment.
Learning aim E – Review the web application
Teachers could build in peer review sessions as learners build practice web applications. The importance of client requirements should be stressed, and that the success of the web application must be judged against these. Has each requirement been met? If yes, how well has it been met? If no, why not. Learners may not have met every single requirement, but what is important is that the learner is honest in their review. Learners should be given multiple opportunities to give and receive peer reviews. They should also be given the opportunity to produce at least one review prior to assessment.

Details of links to other BTEC units and qualifications

This unit links to:

- Unit 2: Software Analysis and Design
- Unit 3: Website Development

Resources

Websites

https://www.decipherzone.com/blog-detail/How-to-Choose-The-Best-Technology-Stack-for-Web-App-Development

This website discusses the technology stack and how to choose one.

www.draw.io

This website has an online application for creating flow charts.

www.w3schools.com

This website allows learners to learn HTML, CSS and JavaScript, server-side scripting languages (e.g. MYSQL) and also gives them interactive practice activities.

https://www.youtube.com/channel/UC9-y-6csu5WGm29I7JiwpnA

This is the YouTube channel for Computerphile. They have good videos that explain SQL injection, etc.

https://www.codecademy.com/learn/learn-html

Code academy runs free courses to help learners understand the fundamental of coding. There are interactive activities which must be completed before moving to the next stage. The end of each chapter has assessment, to help check understanding.

www.csszengarden.com

The CSS Zen Garden website has examples of CSS templates which can be applied to a website design. You could use it to show learners different styles of website layout and how those layouts can be achieved using CSS.

Pearson is not responsible for the content of any external internet sites. It is essential for teachers to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that teachers bookmark useful websites and consider enabling learners to access them through the school/college intranet.

Scheme of work

Unit	Unit 5: Database Development for Web Applications
Guided Learning Hours	120
Number of lessons	40
Duration of lessons	3 hours
Links to other units	• Unit 2: Software Analysis and Design • Unit 3: Website Development

Key to learning opportunities			
AA	Assessment Activity	**RS**	Revision Session
GS	Guest Speaker	**V**	Visit
IS	Independent Study	**WE**	Work Experience

#	Topic	Lesson type	Suggested activities	Resources
1	Introduction to the unit A3 relational database modelling and design • Initial entity relationship diagram	IS	• **Teacher presentation/discussion:** Introduce the unit to learners. Explain reasons why database software is used to hold and manipulate data. • **Small-group activity:** Groups discuss databases that they think they use and databases that they don't use but think might hold data about them. • **Teacher-led discussion:** Discuss the impact of life without a database for a particular area, for example policing. • **Small-group activity:** Each group discusses the impact on an area of life without databases. For example, education, gaming, social media, health care, library, government. Learners then feed thoughts back to the class. • **Teacher-led presentation:** Give an overview of flat file (single table) databases and the problems associated with them. • **Paired activity:** Pairs complete tasks on flat file databases. Then pairs share answers in a class discussion. • **Teacher presentation:** Give an overview of relational databases introducing key features and how they alleviate the problems with a flat file database. • **Teacher-led presentation:** About initial entity relationship diagrams (ERDs). • **Paired activity:** Each pair completes initial ERDs for a range of scenarios. Then pairs share answers in a class discussion.	Dry wipe board or flip chart to collate feedback Teacher presentations and notes Case studies

#	Topic	Lesson type	Suggested activities	Resources
2–3	A3 relational database modelling and design • normalisation	IS	• **Teacher-led presentation:** Give an overview of normalisation. • **Teacher-led demonstration:** Demonstrate how unnormalised data can meet first normal form (1NF). • **Small group/paired activity:** Learners split into pairs. Each pair completes 1NF for a range of scenarios. Learners then discuss with the class. • **Teacher-led demonstration:** Demonstrate how 1NF data can meet second normal form (2NF). • **Small group/paired activity:** Learners split into pairs. Each pair completes 2NF for a range of scenarios. Learners then discuss with the class. • **Teacher-led demonstration:** Demonstrate how 2NF data can meet third normal form (3NF). • **Small group/paired activity:** Learners split into pairs. Each pair completes 3NF for a range of scenarios. Learners then discuss with the class. • **Individual activity:** Learners complete full normalisation for a range of scenarios.	Dry wipe board or flip chart to collate feedback Teacher presentations and notes Computer with word processing software Completed initial ERDs Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
4	A3 relational database modelling and design • Final ERD	IS	• **Teacher-led discussion/demonstration:** Discuss the difference between an initial ERD and a final ERD and demonstrate how to produce a final ERD based upon an initial ERD and 3NF results. • **Small group/paired activity:** Learners split into pairs. Each pair completes final ERDs based upon the initial ERDs and 3NF they produced. Learners then discuss with the class.	Dry wipe board or flip chart to collate feedback Teacher presentations and notes Computers with word processing software Completed initial ERDs, completed normalisation Web application scenarios that can be used throughout unit
5–6	A3 relational database modelling and design • Database structure design	IS	• **Teacher-led presentation:** Give an overview of the purpose of table design documentation, SQL naming conventions, data types, specifying keys and specifying field validation. • **Teacher-led discussion:** Discuss the different data types and give examples of when they should be used. • **Teacher-led discussion/demonstration:** Discuss the different types of validation and when they should be used. Demonstrate how each validation would be written in a table design document. • **Individual activity:** Learners produce table designs for the final ERDs they have completed. Learners then discuss with the class.	Teacher presentations and notes Computers with word processing software Completed final ERDs Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources

7–8	A1 The technology stack
	• Back-end, or server side
	  ○ operating system
	  ○ web server
	  ○ database
	B2 Create the structure of the relational database
		IS	• **Teacher-led presentation:** Give an overview of the back-end aspects of the technology stack.
			• **Teacher-led demonstration:** Demonstrate how to create a database.
			• **Individual activity:** Learners create databases for the table designs they have completed.
				Teacher presentations and notes
				Completed table design documentation
				Computers with internet access, chosen database software, chosen web server
				Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
9–11	B3 Develop front and back-end interaction • Manipulating data using SQL data manipulation language (DML):	IS	• **Teacher-led discussion/demonstration**: Discuss and demonstrate select queries • **Individual activity:** Learners create queries in the databases they have built. • **Teacher-led discussion/demonstration:** Discuss and demonstrate aggregate function queries • **Individual activity:** Learners create aggregate function queries in the databases they have built. • **Teacher-led discussion/demonstration:** Discuss and demonstrate calculated queries. • **Individual activity:** Learners create calculated queries in the databases they have built. • **Teacher-led discussion/demonstration:** Discuss and demonstrate conditional queries • **Individual activity:** Learners create conditional queries. • **Teacher-led discussion/demonstration:** Discuss and demonstrate parameter queries. • **Individual activity:** Learners create parameter queries. • **Teacher-led discussion/demonstration:** Discuss and demonstrate action queries including append, update, delete. • **Individual activity**: Learners create action queries.	Teacher presentations and notes Databases learners have produced Computers with internet access, chosen database software, chosen web server Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
12-15	A1 The technology stack • Front-end, or client side • A2 Page designs B1 Create the front-end of a web application	IS	• **Teacher-led discussion/demonstration**: Learners should already be aware of page sketches for web pages. Recap by discussing and demonstrating the contents of a page sketch. Discuss data handling design. • **Individual activity**: Learners create page sketches, including data handling design, for a web application. • **Individual activity:** Learners should already possess the front-end skills they require to build web pages. Recap by discussing and demonstrating the skills. • **Individual activity:** Learners create the front-end of a web application for one or more of the databases they have built.	Teacher presentations and notes Word processing/desktop publishing software (if page sketches created electronically) Chosen front-end software Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
16	A4 Data handling design • Validation of input • Verification of data • Documentation using algorithms where appropriate • The manipulation of data using SQL data manipulation language (DML)	IS	• **Teacher-led demonstration/discussion:** Learners should already know how to create algorithms from earlier units. Teacher to recap. • **Individual activity:** Learners complete algorithms to demonstrate validation/verification procedures. • **Teacher-led discussion:** Discuss difference between design of SQL and development of SQL. • **Individual activity:** Learners complete SQL designs for a range of SQL statements.	Teacher presentations and notes Computers with word processing software/flowchart software Completed page designs and pages Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources

17–21	A1 The technology stack
	• Back-end, or server side
	  ○ programming language
	  ○ web development framework
	B3 Develop front and back-end interaction
	• Programming in a server side language
	• Validating data
	• Verifying data
	• Development of security
		IS	• **Teacher-led discussion/demonstration**: Discuss and demonstrate how to create programs in a chosen language, chosen development framework and chosen front-end.
			• **Individual activity:** Learners build interaction between the front-end of the web application(s) they have developed and the back-end database.
			• **Teacher-led discussion/demonstration**: Discuss and demonstrate how data can be secured.
			• **Individual activity:** Learners develop security methods.
				Teacher presentations and notes
				Learners back-end databases
				Learners front-end pages
				Learners front-end interaction design
				Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
22	C1 Create a test plan C2 Test the functionality of the web application	IS	• **Teacher-led discussion/demonstrate:** Discuss and demonstrate contents of a test plan to test the functionality of a web application. • **Individual activity:** Learners create a test plan to test one of the web applications they have built. • **Teacher-led discussion/demonstrate:** Discuss and demonstrate carrying out functionality testing of a web application and documenting the results. • **Individual activity:** Learners test a web application using their test plan and document the results.	Teacher presentations and notes Learners back-end databases Learners front-end pages Test plan template Web application scenarios that can be used throughout unit
23–24	D1 Produce a user guide and a technical guide	IS	• **Teacher-led discussion/demonstration**: Discuss purpose and contents of a user guide. • **Individual activity:** Learners create a user guide for one of the web applications they have built. • **Teacher-led discussion/demonstration**: Discuss purpose and contents of a technical guide. • **Individual activity:** Learners create a technical guide for one of the web applications they have built.	Teacher presentations and notes Learners back-end databases Learners front-end pages Web application scenarios that can be used throughout unit

#	Topic	Lesson type	Suggested activities	Resources
25	E1 Review the web application	IS	• **Teacher-led discussion**: Discuss how to review a web application including its suitability for intended purpose, its strengths and any improvements that could be made. • **Individual activity:** Learners complete a review for one of the web applications they have built.	Teacher presentations and notes Learners back-end databases Learners front-end pages Web application scenarios that can be used throughout unit
26–28	Learning aim A assessment	AA	• **Lead-in:** Introduce the assessment Task 1 (see Assessment Workbook) highlighting the main assessment criteria, deadline and submission criteria. • **Individual assessment activity:** Using the Assessment Workbook, learners should complete Task 1.	Computers with internet access Assessment Workbook
29–34	Learning aim B assessment	AA	• **Lead-in:** Introduce the assessment Task 2 (see Assessment Workbook) highlighting the main assessment criteria, deadline and submission criteria. • **Individual assessment activity:** Using the Assessment Workbook, learners should complete Task 2.	Computers with internet access Technology stack Assessment Workbook

#	Topic	Lesson type	Suggested activities	Resources
35–36	Learning aim C assessment	AA	• **Lead-in:** Introduce the assessment Task 3 (see Assessment Workbook) highlighting the main assessment criteria, deadline and submission criteria. • **Individual assessment activity:** Using the Assessment Workbook, learners should complete Task 3.	Computers with internet access Technology stack Assessment Workbook
37–39	Learning aim D assessment	AA	• **Lead-in:** Introduce the assessment Task 4 (see Assessment Workbook) highlighting the main assessment criteria, deadline and submission criteria. • **Individual assessment activity:** Using the Assessment Workbook, learners should complete Task 4.	Computers with internet access Chosen technology stack Assessment Workbook
40	Learning aim E assessment	AA	• **Lead-in:** Introduce the assessment Task 5 (see Assessment Workbook) highlighting the main assessment criteria, deadline and submission criteria. • **Individual assessment activity:** Using the Assessment Workbook, learners should complete Task 5.	Computers with internet access Chosen technology stack Assessment Workbook

#	Topic	Lesson type	Suggested activities	Resources
37–40	Learning aim B Practice assessment	IS/AA	• **Lead-in:** Explain to learners that over the next four lessons they will complete a practice assessment to prepare them for their final assessment of Learning aim B. • **Assessment activity:** Learners take a practice assessment activity that is like the final assessment. • ***Note****: The assessment activity used should follow a similar structure to the final assessment and should be graded against the same criteria. However, the assessment used* ***must not*** *be the same one that will be used to assess their final grade for the unit.*	Computers with IDE installed Practice assessment activity Test plan template

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	1 (3 hours)

Lesson objectives	At the end of the lesson, learners will: • understand the different uses of databases • be able to produce initial entity relationship diagrams (ERDs).

Resources checklist	• Dry wipe board or flip chart to collate feedback • **PS** Presentation on unit introduction • **AS** Activity sheets for flat file database activity • Case studies (web application scenarios that can be used prior to the assessment lessons) • **AS** Activity sheets for initial ERD activities
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Introduction to unit (10 minutes)	• **Teacher presentation/discussion:** Introduction to unit. Explain possible reasons why database software can be used to hold and manipulate data: o you can query (ask questions of) data in a database easily o you can lookup up data o you can relate data o you can create meaningful reports o they can handle very large data sets o multiple users can use them.
Database uses (15 minutes)	• **Small group activity**: Groups discuss databases that they think they use and databases that they don't use but which they think might hold data about them.
Life without databases (10 minutes)	• **Teacher discussion:** Discuss impact of life without a database for a particular area, for example: o policing o education o gaming o social media o health care o library o government.
Life without databases (15 minutes)	• **Small group/paired activity:** Discuss the impact on an area of life without databases, for example, education, gaming, social media, health care, library, government.

Activities	Teaching notes
Flat file databases (10 minutes)	• **Teacher presentation:** give an overview of flat file (single table) databases and the problems associated with them: o flat file database stores data in a single table o made up of columns and rows – column headings – attributes/fields – column – single item of data – row – tuple/record o data redundancy o anomalies – insert – update – delete o problems – storage – speed of access.
Flat file databases (30 minutes)	• **Paired activity:** Pairs complete flat file database related tasks. Teacher to provide a flat file database. Learners should be given specific tasks to complete that will highlight problems.
Introduction to relational databases (5 minutes)	• **Teacher presentation:** give an overview of relational databases introducing key features and how they alleviate the problems with a flat file database: o tables are related through keys o related data is stored in one table only o data in one table can be accessed from another through its key.
Initial entity relationship diagrams (ERDs) (10 minutes)	• **Teacher presentation:** introduce initial entity relationship diagrams (ERDs): o produced before normalisation has been carried out o includes entity names, relationships and relationship types only.
Initial entity relationship diagram activities (70 minutes)	• **Paired activity:** Learners split into pairs. Each pair completes an initial ERD for a range of scenarios.
Concluding activity (5 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	2–3 (6 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • carry out normalisation to third normal form (3NF).

Resources checklist	• Dry wipe board or flip chart to demonstrate answers • **PS** Presentation on normalisation • Case studies (web application scenarios that can be used prior to the assessment lessons) • Sample data sets to go with the case studies • Learners' completed initial ERDs
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes

Introduction to normalisation
 	
(15 minutes)
	• **Teacher presentation:** Give an overview of normalisation, its purpose and rules.
	  ○ Minimises redundancy and improves integrity
	  ○ 1NF: contains no repeating fields
	  ○ 2NF: already in 1NF and has no fields that are not dependent on the whole key
	  ○ 3NF: already in 2NF and it has no non-key dependencies

First normal form (1NF) (15 minutes)	• **Teacher demonstration:** Demonstrate applying 1NF rules to a scenario.
First normal form (1NF) (45 minutes)	• **Small group/paired activity:** Learners split into pairs. Each pair completes 1NF for a range of web application scenarios.
Second normal form (2NF) (15 minutes)	• **Teacher demonstration:** Demonstrate applying 2NF rules.
Second normal form (2NF) (45 minutes)	• **Small group/paired activity:** Learners split into pairs. Each pair completes 2NF for the scenarios they used in the previous activity.
Third normal form (3NF) (20 minutes)	• **Teacher demonstration:** Demonstrate applying 3NF rules.
Third normal form (3NF) (45 minutes)	• **Small group/paired activity:** Learners split into pairs. Each pair completes 3NF for the scenarios they used in the previous activity.
Full normalisation tasks (140 minutes)	• **Individual activity:** Learners individually carry out normalisation from 1NF to 3NF for a range of scenarios and data sets.
Concluding activity (20 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	4 (3 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • combine an initial ERD and 3NF results to produce a final ERD.

Resources checklist	• Dry wipe board or flip chart to demonstrate answers • **PS** Presentation on producing final ERDs • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed initial ERDs and 3NF results
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Final ERD presentation (15 minutes)	• **Teacher presentation:** Demonstrate combining an initial ERD with 3NF results to produce a final ERD: o entities including names o attributes (including keys) o relationships o relationship types.
Final ERD activity (150 minutes)	• **Individual activity:** Learners complete a final ERD for each initial ERD and 3NF results they have completed.
Concluding activity (15 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	5–6 (6 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • produce table designs.

Resources checklist	• **PS** Presentation on normalisation • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed final ERDs • **TF** table design template
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Presentation – naming conventions, key types and general data types (10 minutes)	• **Teacher presentation/discussion:** Introduce and explain the table design template and its contents: o naming conventions o key types o general data types.
Naming conventions, key types and general data types (20 minutes)	• **Individual activity:** Learners use a table design template and one of their final ERDs to complete: o table and field names (using standard naming conventions) o key types o data types for each field.
Presentation – field validation (20 minutes)	• **Teacher presentation/demonstration:** Introduce and explain validation**:** o format check o length check o presence check o range check o lookup check.
Field validation (40 minutes)	• **Individual activity:** Learners use a table design template and one of their final ERDs to complete field validation.
Scenario table designs (4 hours 30 minutes)	• **Individual activity:** Learners produce table designs for each of the scenarios they have completed a final ERD for.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	7–8 (6 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • build tables in a relational database based upon table designs.

Resources checklist	• **PS** Presentation on building relational database tables • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed table designs
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Technology stack introduction (25 minutes)	• **Teacher presentation:** Explain the technology stack and the back-end aspects they will be using.
Demonstration – creating a relational database (25 minutes)	• **Teacher demonstration:** Demonstrate how to create a relational database using the chosen database software: o creating and naming the database and tables o specifying field names, data types and keys o validating fields o creating relationships and ensuring referential integrity o importing data.
Creating a relational database (5 hours)	• **Individual activity**: Learners build a relational database for each full set of table designs they have completed.
Concluding activity (10 minutes)	• **Plenary**: Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	9–11 (9 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • create select, aggregate function, calculated, conditional and parameter queries.

Resources checklist	• **PS** Presentation on building queries • Case studies (web application scenarios that can be used prior to the assessment lessons) • **AS** Query activity sheets for each scenario
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Presentation/ demonstration – select queries (20 minutes)	• **Teacher presentation/demonstration:** Discuss and demonstrate how to create select queries including: o exact match o Boolean o equal to (=) o sort single ascending/descending o wildcards o greater than/greater than or equal to (>, >=, BETWEEN AND) o less than/less than or equal to (<, <=, BETWEEN AND), OR, AND, NOT.
Select queries (90 minutes)	• **Individual activity**: Learners complete select query activity sheet.
Presentation/ demonstration – aggregate function queries (20 minutes)	• **Teacher presentation/demonstration:** Discuss and demonstrate aggregate function queries including: o naming calculated fields o minimum o maximum o count o sum o average o where.
Aggregate queries (90 minutes)	• **Individual activity:** Learners complete aggregate query activity sheet
Presentation/ demonstration - calculated queries (20 minutes)	• **Teacher presentation/demonstration**: Discuss and demonstrate calculated queries including: o addition o subtraction o multiplication o division o dates – determining age – difference between two dates in days/weeks/months/years o where.

Activities	Teaching notes
Calculated queries (90 minutes)	• **Individual activity:** Learners complete calculated query activity sheet.
Presentation/ demonstration – conditional queries (20 minutes)	• **Teacher presentation/demonstration**: Discuss and demonstrate conditional queries e.g. if statements to generate the contents of a field.
Aggregate queries (80 minutes)	• **Individual activity:** Learners complete conditional query activity sheet.
Presentation/ demonstration – parameter queries (20 minutes)	• **Teacher presentation/demonstration:** Discuss and demonstrate parameter queries.
Parameter queries (80 minutes)	• **Individual activity:** Learners complete parameter query activity sheet.
Concluding activity (10 minutes)	• **Plenary**: Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	12–15 (12 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • produce page sketches for web applications • create the front-end of web applications.

Resources checklist	• **PS** Presentation on page sketches • **PS** Presentation on building web pages • Case studies (web application scenarios that can be used prior to the assessment lessons) • **AS** web application front-end activity sheets for each scenario
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Page sketch recap (20 minutes)	• **Teacher discussion/demonstration:** Discuss contents of a page the purpose of the page sketches including: o forms o input controls, e.g.: – cues e.g. asterisks, tooltips, instructions o presentation of output. • Introduce screens (or states) that each page can be in e.g. logged in/logged out. Learners could choose to use different pages altogether or change the content of page depending on the state.
Page sketches (160 minutes)	• **Individual activity:** Learners produce page sketches for one of more of the scenarios they have built databases for.
Presentation/ demonstration – building the front-end of a web application (30 minutes)	• **Teacher presentation/demonstration**: Discuss and demonstrate building the front-end of a web application based upon page sketches.
Building the front-end of a web application (8 hours 30 minutes)	• **Individual activity:** Learners build the front-end of one or more web applications based upon their page sketches.
Concluding activity (10 minutes)	• **Plenary**: Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	16 (3 hours)

Lesson objectives	At the end of the lesson, learners will: • be able to design the validation and verification of data • be able to use algorithms (flowcharts and pseudocode) • understand the difference between the design of SQL and the implementation of SQL • be able to design SQL statements to manipulate data using data manipulation language (DML).

Resources checklist	• **PS** Presentation on data handling design • Case studies (web application scenarios that can be used prior to the assessment lessons) • **AS** data handling design activity sheets for each scenario
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes

Validation and verification recap
 	
(30 minutes)
	• **Teacher presentation/demonstration:** Recap data validation and introduce verification of data. Explain that in this instance this is not the design of validation applied to database fields within the database, it is the design of either client-side validation or server-side validation that is applied before a connection to the database is attempted.
	  ○ Validation:
	  – Format check
	  – Length check
	  – Presence check
	  – Range check
	  ○ Verification of data such as double entry, e.g. making sure no mistakes are made in a password by ensuring they match
	• Demonstrate how both can be expressed in design using algorithms and flow charts.

Validation and verification (60 minutes)	• **Individual activity:** Learners produce validation and verification designs using algorithms for one of more of the scenarios they have built databases for.

Designing SQL statements to manipulate data
 	
(10 minutes)
	• **Teacher presentation/demonstration**: Discuss and demonstrate how SQL statements can be expressed as part of the design process:
	  ○ not written using any particular version of SQL
	  ○ at this level can use a mixture of SQL and written English.
	• Example:
	  ○ SELECT customer_id
	  ○ FROM customer
	  ○ WHERE country = “Uzbekistan”
	  ○ OR country = “England”
	  ○ Sort into ascending order of customer
	  ○ Count number of customers

Design SQL statements to manipulate data (70 minutes)	• **Individual activity:** Learners design SQL statements to manipulate data for one or more of the scenarios they have built databases for.

Activities	Teaching notes
Concluding activity (10 minutes)	• **Plenary**: Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	17–21 (15 hours)

Lesson objectives	At the end of the lesson, learners will: • understand that a technology stack can use many technology services in terms of the back-end of a web application and that they will a particular programming language and web development framework • be able to develop front and back-end interaction in a web application.

Resources checklist	• **PS** Presentation on front and back-end interaction • Case studies (web application scenarios that can be used prior to the assessment lessons) • **AS** interaction activity sheets for each scenario
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Presentation – Programming language and web development framework (10 minutes)	• **Teacher presentation:** Explain which programming language will be used. Learners may or may not use a web development framework, but they need to know they exist and what they are used for.
Presentation– front and back-end interaction (without database interaction) (60 minutes)	• **Teacher presentation:** Explain and demonstrate programming in the chosen programming language (without database interaction at this stage). To include: o common data-handling techniques and data structures o carrying out arithmetic operations o using control structures (sequence, selection and iteration) o using built-in functions and libraries o using mathematical functions o using string handling functions o using functions for handling data in a list/array.
Front- and back-end interaction (without database interaction) (180 minutes)	• **Individual activity:** Learners complete a range of programming activities.
Presentation – manipulation of data using SQL (60 minutes)	• **Teacher presentation:** Explain and demonstrate how to program the manipulation of data using SQL. To include: o commands o clauses o operators o aggregate functions o null functions o string functions o date functions o queries.
Manipulation of data using SQL (180 minutes)	• **Individual activity**: Learners complete a range of programming activities that include database interaction.

Activities	Teaching notes
Implement front and back-end interaction from designs (6 hours 40 minutes)	• **Individual activity**: Learners develop the front- and back-end interaction based upon their designs for one or more scenarios.
Concluding activity (10 minutes)	• **Plenary**: Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	22 (3 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • create a test plan to test the functionality of a web application • test the functionality of a web application and document the results.

Resources checklist	• **PS** Presentation on testing • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed web applications • **TF** testing template
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Presentation demonstration – testing (10 minutes)	• **Teacher presentation/demonstration:** explain the testing template using a completed template to include: o descriptions of the purpose of the identified test o identification of the test data to be used, o identification of the pre-requisite to each test o descriptions of the expected results o screen print evidence o explanation of changes made o retesting where applicable.
Create a test plan (70 minutes)	• **Individual activity:** Learners create a test plan to test one of their completed web applications.
Carry out testing and document the results (90 minutes)	• **Individual activity:** Learners to carry out functionality of one of their web applications using their test plan and document the results.
Concluding activity (10 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	23–24 (6 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • create a user guide • create a technical guide.

Resources checklist	• **PS** Presentation on user and technical guides • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed web applications
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	Teaching notes
Presentation/ demonstration – user guides (20 minutes)	• Teacher presentation/demonstration: Explain the: o purpose and audience of a user guide o the contents that should be present including how to use the application and how to correct errors/troubleshoot o how to structure the information and the importance of avoiding jargon, etc. o different ways to make the information useful and readable.
Create a user guide (155 minutes)	• **Individual activity:** Learners create a user guide based upon one of the web applications they have created.
Presentation/ demonstration – technical guides (20 minutes)	• Teacher presentation/demonstration: Explain: o the purpose and users of a technical guide o the contents that should be present including the relational database structure, SQL for data handling and the web application structure o different ways to make the information useful and readable.
Create a technical guide (155 minutes)	• **Individual activity:** Learners create a technical guide based upon one of the web applications they have created.
Concluding activity (10 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	25 (3 hours)

Lesson objectives	At the end of the lesson, learners will: • review a web application.

Resources checklist	• **PS** Presentation on user and technical guides • Case studies (web application scenarios that can be used prior to the assessment lessons) • Learners' completed web applications
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Presentation/ demonstration – reviewing a web application (15 minutes)	• **Teacher presentation/demonstration:** Explain how to review a web application, including: o how suitable it is for the intended purpose (how well it meets client requirements) o its strengths and any improvements that can be made.
Writing a review (155 minutes)	• **Individual activity:** Learners write a review based upon one of the web applications they have developed.
Concluding activity (10 minutes)	• **Plenary:** Teacher confirms the main learning points identified in the lesson and use oral questioning to confirm learners' understanding.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	26–28 (9 hours)

Lesson objectives	At the end of the lesson, learners will: • be able to carry out the work required for assessment of Learning aim A.

Resources checklist	• Assessment Workbook
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Task 1 assessment presentation (15 minutes)	• **Teacher presentation/discussion**: Introduce the assignment (see Assessment Workbook) detailing the main assessment criteria, deadline and submission criteria. Introduce assessment for Learning aim A.

Task 1 (8 hours 45 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 1. As a rough guide it is recommended that learners divide their time approximately as follows.
	  ○ Activity 1 – 15 minutes
	  ○ Activity 2 – 30 minutes
	  ○ Activity 3 – 30 minutes
	  ○ Activity 4 – 90 minutes
	  ○ Activity 5 – 6 hours

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	29–34 (18 hours)

Lesson objectives	At the end of the lesson, learners will: • be able to carry out the work required for assessment of Learning aim B.

Resources checklist	• Assessment Workbook
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Task 2 assessment presentation (15 minutes)	• **Teacher presentation/discussion**: Introduce assessment for Learning aim B.
Create database structure and import data (6 hours)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 2, Activities 1 and 2 – create the database structure and import the data.
Create the pages and interaction between the front-end and back-end of the application (11 hours 45 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 2, Activity 3 – creating pages and interaction.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	35–36 (6 hours)

Lesson objectives	At the end of the lesson, learners will: • be able to carry out the work required for assessment of Learning aim C.

Resources checklist	• Assessment Workbook
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Task 3 assessment presentation (15 minutes)	• **Teacher presentation/discussion**: Introduce assessment for Learning aim C.
Carry out functionality testing of a web application that uses a relational database to ensure it meets client requirements (5 hours 45 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 3, Activities 1 and 2 – create a test plan, test and document the results.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	37–39 (9 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • carry out the work required for assessment of Learning aim D.

Resources checklist	• Assessment Workbook
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Task 4 assessment presentation (15 minutes)	• **Teacher presentation/discussion**: Introduce assessment for Learning aim D.
Create a user guide for a web application (180 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 4, Activity 1 – user guide.
Create a technical guide for a web application (5 hours 45 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 4, Activity 2 – technical guide.

Lesson plan

Qualification	Pearson BTEC Uzbekistan Level 4 Qualifications in Software Development
Unit	Unit 5: Database Development for Web Applications
Lesson number	40 (3 hours)

Lesson objectives	At the end of the lesson, learners will be able to: • carry out the work required for assessment of Learning aim E.

Resources checklist	• Assessment Workbook
Key: **AS**: Activity Sheet; **TF**: Template Form; **PS**: Presentation Slide	

Activities	**Teaching notes**
Task 5 assessment presentation (15 minutes)	• **Teacher presentation/discussion**: Introduce assessment for Learning aim E.
Produce a review of a web application (165 minutes)	• **Individual activity:** Using the Assessment Workbook, learners should complete Task 5 – web application review.

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