INTERNATIONAL QUALIFICATIONS

AND ASSESSMENT CENTRE (IQAC)

«Approved»

2025 y. «16» Eylul

Programme	**LEVEL 4 EXTENDED DIPLOMA IN DATA SCIENCE**		
Unit Number/ Unit Title	UNIT 4. DATABASE SYSTEMS		
Cohort Code:	L04DBS-U4		
Unit Level	Level 4		
Total GLH	Total qualification time 200/ Total Guided learning hours 90/ Self-guided learning hours 110		
Credits	20 CATS/ 10 ECTS		
Lecturer			
Start Date		**End Date**	

Unit Aims	This module aims to introduce students to the principles and practices of database management systems (DBMS) and their role in data science. Students will be introduced to the fundamental principles and practices of database management systems (DBMS) and their significance in data science. The module will cover various types of DBMS, including relational and non-relational databases, and explore how these systems are used to store, retrieve, and manage data effectively. Key topics will include database design, normalization, SQL querying, and data integrity. By the end of the module, students will have the skills to design and implement efficient database solutions, enabling them to leverage data effectively in their data science projects.
Differentiation Strategies *(e.g. planned activities or support for individual learners according to their needs)*	The total number of students to be in the lesson is approximately 20. This is a multicultural group of students predominantly between the ages of 24 – 45, with numerous ethnic, gender, and creed background. These are UK academic level 5 students; hence it is assumed that they have practical, theoretical, or technological knowledge and understanding of a subject or field of work to find ways forward in broadly defined, complex contexts. These students must be able to generate information, evaluate, synthesise the use information from a variety of sources. Various approaches to addressing the various identified students needs will be adopted throughout the lesson. Such will include:-

	1. Progressive tasks 2. Digital resources 3. Verbal support 4. Variable outcomes 5. Collaborative learning 6. Ongoing assessment 7. Flexible-pace learning
Equality & Diversity	Variety of teaching techniques will be employed to ensure that the needs of each individual learner are met.
Safeguarding & Prevent	Safeguarding policies and the Prevent duty are strictly observed to ensure the safety, well-being, and inclusivity of all students and staff.
Health & Safety	SIRM H&S policies will be maintained.
Learning Resources	**Teaching and Learning Materials**
	• Garcia-Molina, H., Ullman, J. D., & Widom, J. (2008). Database Systems: The Complete Book. Pearson. • Silberschatz, A., Korth, H. F., & Sudarshan, S. (2019). Database System Concepts. McGraw-Hill Education. • Date, C. J. (2012). An Introduction to Database Systems. Pearson.

Learning Outcome	Assessment Criteria
LO1. Understand database fundamentals.	1.1. Explain the basic concepts of database systems, including relational databases and NoSQL databases. 1.2. Design and implement database schemas
LO2. Develop skills in SQL and data manipulation.	2.1 Write SQL queries to retrieve and manipulate data. 2.2 Use database management tools effectively.
LO3. Apply database principles to data-driven applications.	3.1 Integrate databases into applications for data storage and retrieval. 3.2 Optimize database performance and security.

No	Learning Outcome / Topic	Learning and Teaching Activities	Which assessment criteria does the session relate to?	Day/month/ year/ signature
1.	**Introduction to Database Systems**	**Introduction to Database Systems** Purpose, advantages over file systems, DBMS components	LO1: Database Fundamentals	
2.	**Relational Database Concepts**	**Relational Database Concepts** Tables, rows, columns, keys (primary/foreign), relationships	LO1: Database Fundamentals	
3.	**Entity-Relationship (ER) Modeling**	**Entity-Relationship (ER) Modeling** Entities, attributes, relationships, cardinality	LO1: Database Fundamentals	
4.	**Database Normalization**	**Database Normalization** 1NF, 2NF, 3NF, BCNF with practical examples	LO1: Database Fundamentals	
5.	**NoSQL Databases Overview**	**NoSQL Databases Overview** Document (MongoDB), key-value (Redis), columnar (Cassandra), graph (Neo4j)	LO1: Database Fundamentals	
6.	**SQL Basics**	**SQL Basics** `SELECT`, `INSERT`, `UPDATE`, `DELETE` commands	LO2: SQL & Data Manipulation	
7.	**Filtering & Sorting Data**	**Filtering & Sorting Data** `WHERE`, `ORDER BY`, `LIMIT`, `DISTINCT`	LO2: SQL & Data Manipulation	
8.	Half-Term Exam	- Review of LO1 topics - Practice questions and mock assessment - **Half-term assessment** based on LO1 (theory)	LO1 LO2	
9.	**Joins & Subqueries**	**Joins & Subqueries** INNER, LEFT, RIGHT, FULL joins; nested queries	LO2: SQL & Data Manipulation	
10	**Aggregation & Grouping**	**Aggregation & Grouping** `GROUP BY`, `HAVING`, aggregate functions (`SUM`, `AVG`, `COUNT`)	LO2: SQL & Data Manipulation	

11	**Advanced SQL**	**Advanced SQL** Window functions (`OVER`, `PARTITION BY`), CTEs (WITH clauses)	LO2: SQL & Data Manipulation	
12	**Database Management Tools**	**Database Management Tools** MySQL Workbench, pgAdmin, DBeaver	LO3: Database Tools & Management	
13	**Indexing & Performance Tuning**	**Indexing & Performance Tuning** Clustered/non-clustered indexes, query optimization	LO3: Database Tools & Management	
14	Final Exam Preparation & Review	- Comprehensive review of all learning outcomes - Practice questions and revision of key topics		
15	Final Exam	- **Final-term assessment** covering all learning outcomes (theory and practical elements)		
16	Feedback & Reflection	- Review of final exam - Individual feedback on performance - Reflective discussion on key learning points		
17	**Transactions & ACID Properties**	**Transactions & ACID Properties** COMMIT, ROLLBACK, isolation levels	LO3: Database Tools & Management	
18	**Backup & Recovery**	**Backup & Recovery** Full/incremental backups, point-in-time recovery	LO3: Database Tools & Management	
19	**Database Security**	**Database Security** Authentication, authorization, encryption, SQL injection prevention	LO3: Database Tools & Management	
20	**Connecting Databases to Applications**	**Connecting Databases to Applications** Python (SQLAlchemy, Psycopg2), JDBC for Java	LO4: Database Integration & Applications	

21	**ORM (Object-Relational Mapping)**	**ORM (Object-Relational Mapping)** Django ORM, Hibernate basics	LO4: Database Integration & Applications	
22	**APIs & Database Interaction**	**APIs & Database Interaction** RESTful APIs with database backends	LO4: Database Integration & Applications	
23	Half-Term Exam	**Capstone Project** Build a full-stack app with database integration		
24	**Data Warehousing Basics**	**Data Warehousing Basics** Star schema, ETL processes	LO4: Database Integration & Applications	
25	**Big Data & Distributed Databases**	**Big Data & Distributed Databases** Hadoop, Spark SQL introduction	LO4: Database Integration & Applications	
26	**Schema Design Project**	**Schema Design Project** Design a database for an e-commerce platform	LO5: Practical Projects	
27	**SQL Challenge**	**SQL Challenge** Solve complex query problems (e.g., hacker-rank style)	LO5: Practical Projects	
28	**Database Optimization Lab** and **Security Workshop**	**Database Optimization Lab** Indexing strategies, query execution plans **Security Workshop** Prevent SQL injection, implement role-based access	LO5: Practical Projects	
29	Final Exam Preparation & Review	LO1, LO2, LO3, LO4	LO1, LO2, LO3, LO4	
30	Final Exam		LO1, LO2, LO3, LO4	