SYLLABUS

Introduction to the Specialization

This specialization is designed to guide learners through the full journey of becoming a **back-end developer using SQL**. Throughout the program, students will build a strong foundation in databases. Each module is structured to combine theory with hands-on practice, ensuring learners build practical, industry-ready skills.

The specialization combines:

- **Theory + Hands-on practice**
- **Guided labs + "You Try It" coding tasks**
- **Monthly assessments**
- **One final backend project**

By the end of this module, students will be able to write efficient SQL queries, design and implement relational databases, and integrate their database operations into a real backend project.

Graded Practice Quiz

Homework Tasks:

- 30 knowledge-based questions
- Assigned as at-home work
- Each student's score is recorded and included in their monthly performance review

Guided Lab

Practice Session:

- Homework questions and tasks are reviewed in detail
- Instructor provides individual explanations to clarify difficult or unclear topics
- Students continue practicing until they fully understand the concepts

MODULE — SQL & Database Foundations

In this module, you will learn how relational databases work, how to design them effectively, and how to manage and query data using SQL. You will start with the fundamentals of relational database structure, normalization, and constraints. Then you will learn SQL for data retrieval, filtering, aggregation, and combining data across multiple tables.
You will also work with advanced SQL concepts such as subqueries, CTEs, performance optimization, transactions, concurrency, stored procedures, and security practices like preventing SQL injection.
The module also includes practical database development using **EF Core** and AI-assisted SQL writing with

Skills Gained: Understanding the need for Database Management Systems, Setting up SQL Server, Modeling relational databases, Understanding SQL syntax & core functionalities, Using SQL commands:

SELECT, INSERT, UPDATE, DELETE, Using SQL JOINs to combine data, Working with SQL and Aggregate functions, Writing advanced SQL queries (CTE, subqueries), Optimizing SQL queries, Managing transactions & concurrency, Writing stored procedures & functions, Preventing SQL injection, Data modeling and CRUD operations with EF Core, Using Microsoft Copilot for SQL writing & debugging.

TOPICS:

1. Introduction to Databases

- Why We Need Database Management
- Introduction to Relational Databases (RDB)
- Structure of RDB: Tables, Rows, Columns, Primary Keys, Foreign Keys, Schemas
- Principles of RDB Design
    - Avoid redundancy
    - Maintain data integrity
    - Normalization
    - Relationship types: One-to-One, One-to-Many
    - Naming conventions & descriptive column names
- Fundamentals of ACID Properties
- Constraints (PK, FK, Unique, Check, Default, etc.)
- Choosing a DBMS
- Setting Up SQL Server
- Introduction to ORM & how it interacts with relational databases

2. Basics of SQL

- Understanding SQL Syntax
- SQL Command Categories (DML vs DDL)
- Data Retrieval with SELECT
- Writing SELECT Queries
- Sorting & Filtering Data (ORDER BY, WHERE)
- INSERT, UPDATE, DELETE
- SQL JOINs (INNER, LEFT, RIGHT, FULL)
- Combining Data from Multiple Tables
- SQL Functions
- Aggregate Functions (COUNT, SUM, AVG, MIN, MAX)
- Implementing SQL Functions & Aggregations

3. Advanced Data Handling & Optimization

- Subqueries
- Common Table Expressions (CTEs)
- Advanced Filtering Techniques
- Query Optimization & Performance Tips
- Transactions
- Concurrency Control in SQL
- Stored Procedures

- SQL Functions (Scalar & Table-Valued)
- Security: SQL Injection & Best Practices

4. Microsoft Copilot for SQL

- Writing SQL Queries with Microsoft Copilot
- Debugging SQL Queries with Copilot
- Improving Query Efficiency with AI Suggestions

5. Connecting Database with Backend (.NET + EF Core)

- Introduction to Data Modeling with EF Core
- Creating a Simple Database using EF Core
- Writing CRUD Operations (Create, Read, Update, Delete)
- Implementing Database Operations in a Backend Application
- EF Core Migrations & Best Practices