

# Performance Tuning and Optimizing SQL Databases

**Course Duration: 32 Hours (4 Days)**

## Overview

The Performance Tuning and Optimizing SQL Databases course is designed to equip learners with the knowledge and skills required to maintain and optimize the performance of SQL Server databases. This SQL performance tuning course delves into the intricacies of SQL Server architecture, including components, Scheduling, and Wait events. It covers a broad range of topics, from the fundamentals of SQL Server I/O, Database structures, and Memory management to the more advanced concepts of Concurrency, Transactions, and Query plan analysis. Participants will learn how to analyze and troubleshoot performance issues using tools such as Extended Events and the Query Store, understand the importance of accurate Statistics and indexing strategies for query optimization, and explore techniques for caching and recompilation to improve Execution plans. By completing this comprehensive performance tuning course, learners will develop a strong foundation in identifying and solving Performance bottlenecks, ensuring their SQL databases run efficiently and effectively.

## Audience Profile

The Performance Tuning and Optimizing SQL Databases course is designed for IT professionals focused on enhancing database efficiency and health.

- Database Administrators
- Database Developers
- SQL Server Database Engineers
- Data Analysts specializing in performance optimization
- IT Professionals responsible for managing and maintaining SQL Server databases
- System Engineers supporting database servers
- Database Architects focused on optimizing database performance
- SQL Server Consultants
- Technical Support Personnel for SQL Server environments
- Data Professionals preparing for the Microsoft Certified Solutions Expert (MCSE): Data Management and Analytics exam

## Course Syllabus

### Module 1: SQL Server Architecture, Scheduling, and Waits

- This module provides a high-level architectural overview of SQL Server and its components. It delves into the SQL Server execution model, waits, and queues.

#### Lessons:

- SQL Server Components and SQL OS
- Windows Scheduling vs. SQL Scheduling
- Waits and Queues

## **Lab: SQL Server Architecture, Scheduling, and Waits**

**After completing this module, you will be able to:**

- Describe SQL Server components and SQL OS
- Explain the differences between Windows Scheduling and SQL Scheduling
- Understand waits and queues

## **Module 2: SQL Server I/O**

- This module covers core I/O concepts, Storage Area Networks (SANs), and performance testing. It focuses on SQL Server I/O operations and how to test storage performance.

### **Lessons:**

- Core Concepts
- Storage Solutions
- I/O Setup and Testing

## **Lab: Testing Storage Performance**

**After completing this module, you will be able to:**

- Explain the core concepts of SQL I/O
- Describe storage solutions
- Set up and test I/O performance

## **Module 3: Database Structures**

- This module explores database structures, data files, and TempDB internals. It focuses on architectural concepts and best practices for user databases and TempDB.

### **Lessons:**

- Database Structure Internals
- Data File Internals
- TempDB Internals

## **Lab: Database Structures**

**After completing this module, you will be able to:**

- Understand the internal structure of databases

- Explain the internal setup of data files
- Describe the internal setup of TempDB

## **Module 4: SQL Server Memory**

- This module covers Windows and SQL Server memory internals, focusing on architectural concepts and best practices for SQL Server memory configuration.

### **Lessons:**

- Windows Memory
- SQL Server Memory
- In-Memory OLTP

### **Lab: SQL Server Memory**

#### **After completing this module, you will be able to:**

- Understand the components of Windows memory
- Explain SQL Server memory architecture
- Describe In-Memory OLTP

## **Module 5: SQL Server Concurrency**

- This module covers transactions and locking internals, focusing on concurrency, transactions, isolation levels, and locking mechanisms.

### **Lessons:**

- Concurrency and Transactions
- Locking Internals

### **Lab: SQL Server Concurrency**

#### **After completing this module, you will be able to:**

- Explain concurrency and transactions
- Understand SQL Server locking mechanisms

## **Module 6: Statistics and Index Internals**

- This module covers statistics and indexing, focusing on architectural concepts and best practices related to SQL Server statistics and indexes.

### **Lessons:**

- Statistics Internals and Cardinality Estimation
- Index Internals

- Columnstore Indexes

## **Lab: Statistics and Index Internals**

**After completing this module, you will be able to:**

- Understand statistics internals and cardinality estimation
- Explain the purpose and functioning of indexes
- Implement and use Columnstore indexes

## **Module 7: Query Execution and Query Plan Analysis**

- This module covers query execution and query plan analysis, focusing on the SQL Server optimizer and troubleshooting query plan issues.

### **Lessons:**

- Query Execution and Optimizer Internals
- Query Execution Plans
- Analyzing Query Execution Plans
- Adaptive Query Processing

## **Lab: Query Execution and Query Plan Analysis**

**After completing this module, you will be able to:**

- Understand query execution and the SQL Server optimizer
- Analyze query execution plans and troubleshoot common issues

## **Module 8: Plan Caching and Recompilation**

- This module explores plan caching and recompilation, including troubleshooting scenarios and best practices for optimizing the plan cache.

### **Lessons:**

- Plan Cache Internals
- Troubleshooting Plan Cache Issues
- Automatic Tuning
- Query Store

## **Lab: Plan Caching and Recompilation**

**After completing this module, you will be able to:**

- Understand plan cache functionality
- Troubleshoot plan cache issues

- Explain the Query Store and its benefits

## **Module 9: Extended Events**

- This module provides an in-depth look at Extended Events, focusing on troubleshooting strategies and usage scenarios.

### **Lessons:**

- Core Concepts of Extended Events
- Implementing and Working with Extended Events

### **Lab: Extended Events**

#### **After completing this module, you will be able to:**

- Understand the core concepts of Extended Events
- Implement Extended Events for monitoring and troubleshooting

## **Module 10: Monitoring, Tracing, and Baselineing**

- This module covers tools and techniques for monitoring, tracing, and establishing performance baselines in SQL Server. It focuses on data collection strategies and analysis techniques.

### **Lessons:**

- Monitoring and Tracing
- Baselineing and Benchmarking

### **Lab: Monitoring, Tracing, and Baselineing**

#### **After completing this module, you will be able to:**

- Understand various monitoring and tracing options
- Implement benchmarking and baselineing techniques for performance optimization