Modern .NET/C# Course Syllabus.

.NET Introduction

- .NET Framework Overview.
- .NET Standart/.NET Framework/.NET Core/.NET
- Applications that can be developed using .NET
- MSIL.
- The Common Language Runtime (CLR).
- Managed and Unmanaged Code.
- Common Type System (CTS).
- Common Language System (CLS).
- Compilation.
    - JIT.
    - OSR (On Stack Replacement).
    - AOT.
    - PGO.
    - SIMD.

.NET Main Entry Point, Project, and Solution Introduction.

- .NET Project and Solution Overview.
- Entry Point Method – Main (Program.cs).
- Restore, Build, Run Application and Pack Application.
- Application Exit Code.
- Run application using input arguments.

.NET/C# Syntax.

- Program structure.
- Top-level statements – program without *Main* method.
- Variables and Datatype.
- Types Aliases.
- Strings.
    - Formatting.
    - Multiline string.

    - UTF-8 string literals.
- Value Types and Reference Types.
- Nullable types.
    - Null operators.
- Introduction to **HEAP** and **STACK** Memory.
- Where does variables are allocated?
- Implicit and Explicit Casting.
- Boxing & Unboxing.
- Enumerations and Constraints.
- Operators.
- Arrays.
    - Inline arrays.
- Loops.
    - For.
    - Foreach.
    - While.
    - Do-While.
- Boolean operators.
    - Ternary operator.
    - If – operator.
    - Switch – operator.
    - Switch – expression.
- Methods.
    - Delegates.
    - Lambda expressions.
    - Default Values for Lambda Parameters.
    - Static modifier for Lambda Expression.
- Input parameters: in, out, ref.

Object-Oriented Programming (OOP).

- OOPs concept.
    - What is the Namespace.
    - Struct.
    - Class.

        - Properties (get, set, init).
        - Read-only properties.
        - Required properties.
        - Partial Class and Methods.
        - Sealed, Class and Method.
        - Static Class, Fields, and Methods.
        - Methods Overloading.
        - Operator Overloading.
        - Extension Methods.
        - Anonymous Types.
        - Tuples.
        - Primary Constructors.
        - Static Constructors.
    - Abstract Class.
        - Virtual, Override, New, Abstract.
    - Interface.
        - Default implementation of methods.
        - Static members.
    - Access Modifier.
    - Interceptors.
- OOP features.
    - Inheritance.
    - Polymorphism.
    - Abstraction.
    - Encapsulation.

Functional Techniques.

- Pattern matching.
    - Null checks.
    - Type tests.
    - Relational Patterns.
    - Multiple Inputs.
    - List patterns.
- Discards.
- Deconstructing types.

Exceptions/Errors and error handling.

- Exceptions, Throw Exception. Built-In Exceptions.
- Try…Catch…Finally… block.
- Custom Exceptions.
- Compiler-generated exceptions.

SOLID.

- Single Responsibility Principle (SRP).
- Open/Closed Principle (OCP).
- Liskov Substitution Principle (LSP).
- Interface Segregation Principle (ISP).
- Dependency Inversion Principle (DIP).

Generics.

- Generic Types.
- Covariance & Contravariance.

.NET Collections.

- Introduction to .NET Collections.
- Different types of collections.
- ICollection.
- IList.
- IEnumerable.
- Iterator.
- Indexator.
- Dictionary.
- List.
- Queue.
- SortedList.
- Stack.
- ArrayList.
- Hashtable.
- Stack.
- Immutable Collections.

- Complexity of collections.

Reflection and Attributes.

- Introduction.
- Create custom attributes.
- Generic and Attributes.
- Introduction to Reflection.
- Generic and Reflection.
- Assembly class.

JSON.

- Introduction to JSON.
- System.Text.Json.
- Json Code Generation.

Regex.

- Introduction to Regex.
- Caching Regex.
- Regex Code Generation.

Delegates and Events.

- What is Delegates.
- Strongly Typed Delegates.
- Common Patterns for Delegates.
- Introduction to events.
- Standart .NET event patterns.
- Distinguishing Delegates and Events.

Managed and Unmanaged Code/Resources.

- What is managed and Unmanaged Resources.
- Automatic memory management.
- What is GC, and how it works.
- Memory Leak in .NET.
- What is Dispose Pattern. Finalizer and Deconstructer.

- Stackallock, Span or how to write zero-allocation code.

LINQ.

- What is LINQ (Language-Integrated Query).
- Deferred and Immediate Queries.
- Projection (Select, SelectMany).
- Filter (Where).
- Sort.
- Aggregate.
- Skip, Take.
- Grouping.
- Join.
- All, Any, Contains, First, Single, Last, Distinct.

Asynchronous Programming. Threads and Tasks.

- Managed threading basics.
    - Threads and threading.
        - Schedule threads.
        - Cancel threads.
        - Destroy threads.
    - Exceptions in managed threads.
    - Timers.
- Asynchronous Programming.
    - Asynchronous Programming Introduction.
    - Asynchronous Programming Scenarios.
    - Task Asynchronous Programming Model.
    - Async Return Types.
    - Cancel Tasks.
    - Process asynchronous tasks as they complete.
    - ValueTask usage.
    - TAP at runtime and under the hood.
- Concurrency and Parallelism.
- IAsyncEnumerable (non-blocking enumeration).
- IAsyncEnumerable - cancel asynchronous iterations.

- IAsyncEnumerable - under the hood.

Database. SQL. PostgreSQL.

- SQL Fundamental Concepts.
- What is SQL & why is it used?
- Flavors of SQL: Postgres vs SQL Server, etc.
- Database Tables, Rows, & Columns.
- SQL Queries
    - SELECT. Selecting all columns or specific columns.
    - Limiting records.
    - Ordering records.
    - Distinct records.
    - Comparison Operators: =, <, >, !=, etc.
    - Filtering records.
- Table relationships.
    - Primary Keys.
    - Foreign Keys.
    - Database Relations: One2One, One2Many, Many2Many.
- Joins.
    - Inner Join.
    - Outer Join.
    - Left Join.
    - Right Join.
- Aggregating records.
    - SUM.
    - COUNT.
    - AVG.
    - MAX.
    - MIN.
- Grouping Data.
- Transactions.

ADO .NET.

- Connection Strings.

- Connections.
- Connection Pool.
- SqlCommand Class.
- SqlDataReader Class.
- Transactions.

Entity Framework Core.

- Introduction to EF Core.
- DBContext Configuration and Initialization.
- Create Model.
    - Entity Types.
    - Entity Properties.
    - Keys.
    - Relationships.
    - Index and Constraints.
- Manage database schemas.
    - Migrations.
- Query Data.
    - How queries works.
    - Split queries.
    - Complex queries operations.
    - Pagination.
- Save Data.
- Performance.

ASP .NET CORE.

- ASP .NET Core Basics.
    - MVC.
    - REST.
    - Minimal APIs.
    - Routes with Cancellation Token.
    - Application Settings and Configurations.
    - Middlewares.
    - Filters and Attributes.

        - Authentication and Authorization.
        - Swagger.
        - Rate-limiting.
        - JSON serialization of compiler-generated IAsyncEnumerable<T> types
- Model Validation:
    - Built-In Model Validation.
    - Fluent-Validation.
- Dependency Injection.
    - DI Containers.
    - Life Cycles.
        - Scoped.
        - Transient.
        - Singleton.
- Streaming.
    - Using IAsyncEnumerable to stream data.
- Caching.
    - Memory Cache.
    - Response Caching.
    - Redis.
- Log Frameworks.
    - Logging.
- Background Task Scheduler.
    - Hosted Service.
- Ahead-of-time (AOT).
    - Native AOT.
    - AOT SIMD.