



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Computer Engineering / Computer Science and Engineering

Subject Code: DI05000131

Subject Name: Client - Side Scripting Language (TypeScript)

W.E. F. Academic Year:	2026-27
Semester:	5 th
Category of the Course:	PEC-04

Prerequisite:	Students should have basic knowledge of: • HTML and CSS for basic web page design • JavaScript fundamentals including DOM manipulation
Rationale:	Modern web applications require scalable, maintainable, and type-safe code. TypeScript enhances JavaScript by adding static typing, modern object-oriented features, and strong tooling support, and it is widely used in frameworks such as Angular, React, and Node.js. This course helps students transition from basic JavaScript to professional front-end development practices, enabling them to build structured and maintainable web applications used in industry.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
01	Use TypeScript data types, variables, and functions to develop programs	Apply
02	Develop programs using TypeScript functions and advanced type features	Apply
03	Implement object-oriented programming concepts using classes and interfaces in TypeScript	Apply
04	Develop dynamic frontend applications by integrating TypeScript with backend services and APIs.	Apply

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
0	2	4	4	0	0	20	30	50



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to TypeScript: • Need for TypeScript in modern web development • Limitations of JavaScript • Features of TypeScript • Installing Node.js and TypeScript • TypeScript Compiler (tsc) • Writing and compiling first TypeScript program • TypeScript configuration (tsconfig.json) • Using TypeScript in browser applications	5	17
2.	TypeScript Basics • Basic Data Types ○ number ○ string ○ boolean ○ any ○ unknown ○ void ○ null & undefined • Type inference • Variables and constants • Basic Operators (Arithmetic, Logical, Comparison) • Arrays and Tuples • Union Types • Type Aliases • Enums	5	17



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3.	Functions and Advanced Types • Functions in TypeScript • Function parameters ▪ optional parameters ▪ default parameters ▪ rest parameters • Arrow functions • Function overloading • Type assertions • Introduction to Generics (conceptual understanding) • Error handling using try-catch • Compile-time vs runtime errors	6	20
4.	Object-Oriented Programming and Code Organization • Classes and Objects • Constructors • Access Modifiers ▪ public ▪ private ▪ protected • Getters and Setters • Inheritance • Interfaces • Abstract classes • Static members • Modules: Import and Export • Namespace vs Modules • Real-world examples (Student/Product systems)	6	20



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5.	Modules, DOM Programming, and Backend Integration TypeScript with HTML and DOM Manipulation • DOM manipulation using TypeScript • Accessing and modifying HTML elements Event Handling and Form Processing • Typed events (MouseEvent, KeyboardEvent) • Working with HTML forms • Form input handling and validation (basic) Fetch API and JSON Handling • Working with API responses • JSON parsing and handling • Displaying dynamic data in HTML Backend and API Concepts • Concept of backend in web applications • Communication between frontend and backend using APIs • Overview of client-server architecture Backend Integration and Database Connectivity • Using any backend technology (<i>Recommended: PHP</i>) • Database interaction with MySQL • Retrieving data from database • Returning JSON from backend Frontend–Backend Integration • Fetching data using TypeScript (Fetch API) • Handling API responses • Displaying data dynamically in frontend	8	26
	Total	30	100



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References/Suggested Learning Resources:

(a) Books:

1. Programming TypeScript: Making Your JavaScript Applications Scale, Boris Cherny, O'Reilly Media, 2019, ISBN: 978-1492037651.
2. Learning TypeScript: Enhance Your Web Development Skills Using Type-Safe JavaScript, Josh Goldberg, O'Reilly Media, 2022, ISBN: 978-1098110338.
3. TypeScript Quickly, Yakov Fain and Anton Moiseev, Manning Publications, 2020, ISBN: 978-1617295942.
4. Effective TypeScript: 62 Specific Ways to Improve Your TypeScript, Dan Vanderkam, O'Reilly Media, 2019, ISBN: 978-1492053743.
5. Beginning TypeScript: From Novice to Professional, Ben Grynhaus, Apress, 2021, ISBN: 978-1484262392.

(b) Open source software and website:

1. **TypeScript Official Documentation** – Comprehensive guide to TypeScript concepts and features.
<https://www.typescriptlang.org/docs/>
2. **Microsoft Learn – TypeScript Fundamentals** – Beginner-friendly introduction to TypeScript programming.
<https://learn.microsoft.com/en-us/training/modules/typescript-get-started/>
3. **W3Schools – TypeScript Tutorial** – Practical examples and exercises for beginners.
<https://www.w3schools.com/typescript/>
4. **GeeksforGeeks – TypeScript Tutorial** – Covers TypeScript basics, OOP concepts, and examples.
<https://www.geeksforgeeks.org/typescript/>
5. **tutorialspoint – TypeScript Tutorial** – Step-by-step explanation of TypeScript features and syntax.
<https://www.tutorialspoint.com/typescript/index.htm>
6. **FreeCodeCamp – TypeScript Full Course** – Beginner-friendly course with practical examples.
<https://www.freecodecamp.org/news/learn-typescript-beginners-guide/>
7. **MDN Web Docs – JavaScript and TypeScript Resources** – Documentation on JavaScript and related technologies used with TypeScript.
<https://developer.mozilla.org/>
8. **TypeScript Playground** – Online editor for writing and testing TypeScript code.
<https://www.typescriptlang.org/play>
9. **Node.js Official Website** – Required runtime environment for TypeScript development.
<https://nodejs.org/>
10. **GitHub – TypeScript Repository** – Official TypeScript project and examples.
<https://github.com/microsoft/TypeScript>



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Suggested Course Practical List:

1. Install Node.js and TypeScript, create a simple TypeScript program to display a message and execute it using the TypeScript compiler.
2. Write a TypeScript program demonstrating basic data types (number, string, boolean, any) to store and display student information.
3. Write a TypeScript program to perform operations on arrays and tuples to store and display product details.
4. Write a TypeScript program to create reusable functions (including arrow functions) to perform basic arithmetic operations.
5. Write a TypeScript program to implement classes and objects to store and display student details.
6. Write a TypeScript program demonstrating interfaces and inheritance to model a simple employee management example.
7. Write a TypeScript program to create modules using export and import to perform mathematical operations.
8. Create a web form and write a TypeScript program to validate user inputs such as name, email, and age.
9. Write a TypeScript program to fetch data from a public API and display the results on a webpage.
10. Develop a simple web application (e.g., To-Do List or Task Manager) using TypeScript demonstrating classes, arrays, and DOM manipulation.

List of Laboratory/Learning Resources Required:

1. **Computer System Configuration:** Desktop or Laptop with minimum specifications:
 - Processor: Intel i3 (or equivalent) and above
 - RAM: 8 GB (recommended for database and virtualization tasks)
 - Storage: Minimum 256 GB SSD / HDD
 - Operating System: Windows 10/11, Ubuntu Linux, or macOS
2. **Software Requirements**
 - **Node.js – JavaScript Runtime Environment**
 - Download: <https://nodejs.org/>
 - Used to run TypeScript applications and manage packages
 - **TypeScript Compiler (tsc)**



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- Install using npm: `npm install -g typescript`
- Used to compile TypeScript code into JavaScript
- **Visual Studio Code – Code Editor**
 - Download: <https://code.visualstudio.com/>
 - Recommended extensions: TypeScript, ESLint, Prettier
- **Web Browser (Google Chrome / Mozilla Firefox)**
 - Used to test web applications and DOM-based programs
- **Node Package Manager (npm)**
 - Used to manage libraries and dependencies in TypeScript projects
- **TypeScript Playground (Online Editor)**
 - <https://www.typescriptlang.org/play>
 - Useful for experimenting with TypeScript code without installation

Suggested Project List:

1. Student Management System

Design a TypeScript-based application to manage student details, including adding, updating, and displaying student information using classes and arrays.

2. To-Do List / Task Manager Application

Develop a web-based task manager using TypeScript to add, display, update, and delete tasks with DOM manipulation and event handling.

3. Product Catalog Management System

Create a TypeScript application to manage product details such as product ID, name, price, and category using interfaces and object-oriented programming concepts.

4. Simple Calculator Web Application

Build a calculator using TypeScript that performs arithmetic operations and demonstrates reusable functions and event handling.

5. Form Validation System



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Develop a TypeScript-based form validation system that verifies user inputs such as name, email, password, and age before form submission.

6. Weather Information Dashboard

Create a web application that fetches weather data from a public API and displays location-based weather information dynamically on a webpage.

7. User Data Viewer using Public API

Fetch and display user information from an external API and present it in a structured table format using TypeScript and DOM manipulation.

8. Expense Tracker Application

Develop a small TypeScript application to record daily expenses, calculate totals, and display expense reports.

9. Simple Quiz Application

Build an interactive quiz system using TypeScript that presents questions, evaluates answers, and calculates scores.

10. Online Book Catalog Viewer

Develop a TypeScript-based web application to display book details from a dataset or API and allow users to search or filter books.

Beyond these projects, students should:

- Practice TypeScript programming concepts such as types, interfaces, classes, and modules.
- Develop interactive web pages using TypeScript and DOM manipulation.
- Explore integration with public APIs for real-time data retrieval.
- Understand how TypeScript improves maintainability and scalability of JavaScript applications.
- Build small web applications that demonstrate modular and reusable code design.

Suggested Activities for Students:



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In addition to classroom and laboratory sessions, students are encouraged to participate in the following **co-curricular and experiential learning activities**. These activities strengthen conceptual understanding, teamwork, and practical development skills using TypeScript.

Recommended Activities

a) Hands-on Practical Sessions in a Controlled Lab Environment

- Conduct structured programming exercises demonstrating **TypeScript syntax, types, functions, classes, and modules**.
- Practice **DOM manipulation, event handling, and form validation** using TypeScript.

b) Web Application Development Exercises

- Develop small web applications such as **task managers, calculators, or student management systems**.
- Implement features such as **data handling, user interaction, and modular programming**.

c) Integration with Web APIs

- Fetch and display real-time data from public APIs such as weather services or user datasets.
- Explore how TypeScript improves reliability and error detection in API-based applications.

d) Code Quality and Maintainability Practices

- Apply TypeScript's static typing features to reduce runtime errors.
- Organize programs using modules, interfaces, and object-oriented design for better maintainability.

e) Study and Presentation of Modern Web Development Practices

- Study how TypeScript is used in modern frameworks such as Angular, React, and Node.js applications.
- Present findings on benefits of TypeScript in large-scale software development and frontend engineering.