



Project No.
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المعهد الهندسي لخدمات التكنولوجيا والبرمجيات

Engineering office for Technology and Software Services

✂ Compiler Construction Course



Course Code: 27020-COs

Academy: Engineering Office for Technology and Software Services

Main Branch: United building – E Shams –Front NBE
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✚ Introduction

Compiler Construction dives deep into the engineering behind building compilers — software that translates high-level programming languages into executable code. This course blends **theoretical foundations** with **practical implementation**, guiding learners through the full pipeline of a compiler: from scanning and parsing to code generation and optimization.

🎯 Course Modules

◆ Module 1: Introduction to Compiler Construction

- What is a **Compiler** and why do we need it?
- Differences between **Compiler** and **Interpreter**
- Phases of compiler construction (Compilation Phases)

◆ Module 2: Lexical Analysis

- Definition and role of **Lexical Analysis**
- Writing a **Lexer** and analyzing **Tokens**
- Tools for lexical analysis (e.g., **Flex**)

◆ Module 3: Syntax Analysis

- Definition of **Syntax Analysis** and building a **Parse Tree**
- Grammar rules and language syntax
- Types of parsers (e.g., **LL**, **LR**)

◆ Module 4: Semantic Analysis

- Semantic checking and validation

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- Managing **Symbol Tables**
- Scope management and **Type Checking**

◆ **Module 5: Intermediate Code Generation**

- What is **Intermediate Code**?
- Representing code as **Three Address Code**
- Translating arithmetic and logical expressions into intermediate code

◆ **Module 6: Code Optimization**

- Intermediate-level code optimization
- Reducing code size and improving efficiency
- Optimization techniques like **Loop Optimization**

◆ **Module 7: Target Code Generation**

- Translating intermediate code into **Machine Code**
- Register allocation strategies
- Generating optimized code for various processors

◆ **Module 8: Memory Management**

- Memory allocation and management during execution
- Handling variables, **Stack**, and **Heap**
- Garbage collection strategies

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◆ Module 9: Practical Applications and Projects

- Building a simple compiler for a custom programming language
- Using tools like **Flex** and **Bison**
- Implementing and optimizing target code on a chosen platform
-  **Course Outcomes**

By the end of this course, you will be able to:

-  Understand and implement each stage of the compiler pipeline
-  Construct lexical and syntax analyzers using tools like **Lex/Flex** and **Yacc/Bison**
-  Analyze and implement semantic checks, intermediate code, and optimizations
-  Generate target machine or bytecode from intermediate representations
-  Develop a **working compiler** for a small custom programming language
-  Use modern compiler tools such as **LLVM** and **ANTLR** in practical contexts
-  Apply formal language and automata theory in real-world applications

Time Frame

- **Duration:** 8 Weeks
- **Sessions:** 16 sessions (2 per week)
- **Session Length:** 1.5 to 2 hours per session
- **Project Work:** Weekly assignments and a final compiler project

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Course Format

- **Live or recorded lectures** with hands-on code walkthroughs
- **Practical Labs** after every core module
- **Code assignments and quizzes** via learning platform (LMS)
- **Compiler Construction Project**: build your own basic language compiler
- **Mentor support & discussion forum** for Q&A
- **Certificate** awarded upon successful completion and project submission

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