

MSc Computer Science Syllabus First Year (2018-2023)
Principles of programming language

Semester I

Subject Code: MS11801

Lectures: 60

Objectives:

The syllabus aims in equipping students with,

- To analyze the strengths and weaknesses of programming languages for effective and efficient program development,
- To inculcate the principles underlying the programming languages enabling to learn new programming languages,
- To briefly describe various programming paradigms,
- To understand the issues involved in programming language design and implementation,

Unit 1: Introduction

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Ch 1. Introduction to the programming languages

well done

- History and need of various types of Programming Languages(PL).
- Types of programming languages(PL).
- Characteristics of programming languages PL.
- Syntax, Semantics, Pragmatics Analysis of programming languages.

Unit 2:Non-Imperative Programming Models: Functional Logic Languages

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Ch 2.Basic LISP Primitives

- Basic LISP Primitives (FIRST, REST, SETF, CONS, APPEND, LIST,
- NTHCDR, BUTLAST, LAST, LENGTH, REVERSE, ASSOC)
- Procedure definition and binding, DEFUN, LET
- Predicates and Conditional,
- EQUAL, EQ, EQL, =, MEMBER, LISTP, ATOM, NUMBERP, SYMBOLP, NIL, NULL, IF, WHEN, UNLESS, COND, CASE
- Procedure Abstraction, Recursion.
- Arrays.

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BOS Members:

Dr. ReenaBharati(Subject Expert)

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Dr. JyotiYadav(Subject Expert)

Mr. Vishal Salke(Industry Expert)

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Ch 3. Introduction to Turbo Prolog

- facts, Objects and Predicates, Variables, 08
- Using Rules, controlling execution fail and cut predicates.
- Recursion, Compound objects, List, Strings.

Unit 3: Scope and control flow in programming languages.

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Ch 4. Names, Scopes, and Bindings

- The Notion of Binding Time 05
- Object Lifetime and Storage Management
- Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection
- Scope Rules .
- Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope .
- Aliases, Overloading, Polymorphism and Related Concepts The Binding of Referencing Environments
- Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures, Macro Expansion.

Ch 5. Control Flow

- Expression Evaluation 05
 - Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions,
 - Short-Circuit Evaluation.
- Structured and Unstructured Flow
 - Structured Alternatives goto.
- Sequencing.
- Selection
 - Short-Circuited Conditions, Case/Switch Statements.
- Iteration
 - Enumeration-Controlled Loops, Combination Loops, Iterators, Controlled Loops.
- Recursion.
- Iteration and Recursion, Applicative- and Normal-Order evaluation.

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Unit 3: Datatypes	10
➤ Ch 6. Datatypes	10
• Primitive Data Types	
• Numeric Types	
• Integer, Floating point, Complex, Decimal, Boolean Types,	
• Character Types	
➤ Character String Types	
➤ Design Issues	
➤ Strings and Their Operations	
➤ String Length Operations	
➤ Evaluation	
• Implementation of Character String types	
• User defined Ordinal types	
• Enumeration types	
➤ Designs	
➤ Evaluation	
• Subrange types	
➤ Ada's design : Example	
➤ Evaluation	
➤ Implementation of used defined ordinal types	
• Array types	
➤ Design issues	
➤ Arrays and indices	
➤ Subscript bindings and array categories	
➤ Heterogeneous arrays	
➤ Array initialization	
➤ Array operations	
➤ Rectangular and Jagged arrays	
➤ Slices	
➤ Evaluation	
➤ Implementation of Array Types	
➤ Associative Arrays	
➤ Implementing associative arrays.	

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- Record type
 - Definitions of records .
 - References to record fields .
 - Operations on records .
 - Evaluation .
 - Implementation of Record types .
- Pointer and Reference Types.
 - Design issue
 - Pointer operations .
 - Pointer problems.
 - Dangling pointers
 - Lost heap dynamic variables
- Comparison of Pointers in C and C++
- Reference types
- Evaluation .
- Implementation of pointer and reference types
 - Representation of pointers and references
 - Solution to dangling pointer problem.

Unit 4: Subroutines and Control Abstraction 12

Ch 7. Subroutines 06

- Fundamentals of Subprograms Design Issues for subprograms .
- Local Referencing Environments .
- Parameter-Passing Methods .
- Parameters that are Subprograms .
- Overloaded Subprograms .

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- **Generic Subroutines**
 - Generic Functions in C++ .
 - Generic Methods in Java .
 - Design Issues for Functions.
 - User-Defined Overloaded Operators .
 - Coroutines.
 - The General Semantics of Calls and Returns .
 - Implementing “Simple” subprograms.
 - Implementing Subprograms with Stack-Dynamic Local Variables .
 - Nested Subprograms .
 - Blocks .
 - Implementing Dynamic Scoping .

06

Ch 8. Data Abstraction and Object Orientation

- Object-Oriented Programming
- Encapsulation and Inheritance
- Modules, Classes, Nesting (Inner Classes), Type



- Extensions, Extending
without Inheritance
- **Initialization and Finalization**
 - Choosing a Constructor, References and Values, Execution Order, GarbageCollection
 - **Dynamic Method Binding**
 - Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup,
 - Polymorphism, Object Closures
 - **Multiple Inheritance**
 - Semantic Ambiguities, Replicated Inheritance, Shared Inheritance,
 - Mix-In Inheritance

References books

1. Kaufmann Publishers, An Imprint of Elsevier *Scott Programming Language Pragmatics*, ISBN 9788131222560.
2. Robert W. Sebesta, Pearson Education. *Concepts of Programming Languages*, Eighth Edition .
3. Carl Townsend .*Introduction to Turbo Prolog* .
4. Patrick Henry Winston & Berthold Klaus Paul Horn 3rd edition- *LISP* .
(BPB Publication)
5. M. Gabbielli, S. Martini, Springer ,*Programming Languages: Principles and Paradigms*, ISBN: 9781848829138.

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