

## 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**

02

**Ch 1. Introduction to the programming languages**

- Map showing*
- 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**

14

**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.

06

BOS Members:

Dr. ReenaBharati(Subject Expert)

Dr. ManishaBharambe(Subject Expert)

Dr. JyotiYadav(Subject Expert)

Mr. Vishal Salke(Industry Expert)

Ms. AmrutaNambiar(Alumni)

Prof. AshwiniKulkarni (Chairman and Internal Faculty)

Prof. Smita Borkar (Internal Faculty)

*Handwritten signatures:*  
 MS  
 Salke  
 Yadav  
 Nambiar  
 Kulkarni  
 Borkar



<b>Ch 3. Introduction to Turbo Prolog</b>	
<ul style="list-style-type: none"> <li>➤ facts, Objects and Predicates, Variables,</li> <li>➤ Using Rules, controlling execution fail and cut predicates.</li> <li>➤ Recursion, Compound objects, List, Strings.</li> </ul>	<b>08</b>
<b>Unit 3: Scope and control flow in programming languages.</b>	<b>10</b>
<b>Ch 4. Names, Scopes, and Bindings</b>	
<ul style="list-style-type: none"> <li>➤ The Notion of Binding Time</li> <li>➤ Object Lifetime and Storage Management</li> <li>➤ Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection</li> <li>➤ Scope Rules .</li> <li>➤ Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope .</li> <li>➤ Aliases, Overloading, Polymorphism and Related Concepts The Binding of Referencing Environments</li> <li>➤ Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures, Macro Expansion.</li> </ul>	<b>05</b>
<b>Ch 5. Control Flow</b>	
<ul style="list-style-type: none"> <li>• Expression Evaluation                             <ul style="list-style-type: none"> <li>➤ Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions,</li> <li>➤ Short-Circuit Evaluation.</li> </ul> </li> <li>• Structured and Unstructured Flow                             <ul style="list-style-type: none"> <li>➤ Structured Alternatives goto.</li> </ul> </li> <li>• Sequencing.</li> <li>• Selection                             <ul style="list-style-type: none"> <li>➤ Short-Circuited Conditions, Case/Switch Statements.</li> </ul> </li> <li>• Iteration                             <ul style="list-style-type: none"> <li>➤ Enumeration-Controlled Loops, Combination Loops, Iterators, Controlled Loops.</li> </ul> </li> <li>• Recursion.</li> <li>• Iteration and Recursion, Applicative- and Normal-Order evaluation.</li> </ul>	<b>05</b>

BOS Members:

Dr. ReenaBharati(Subject Expert)

Dr. ManishaBharambe(Subject Expert)

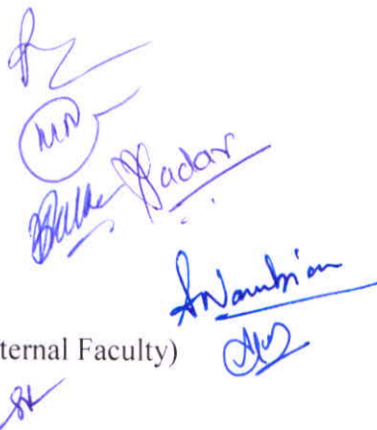
Dr. JyotiYadav(Subject Expert)

Mr. Vishal Salke(Industry Expert)

Ms. AmrutaNambiar(Alumni)

Prof. AshwiniKulkarni (Chairman and Internal Faculty)

Prof. Smita Borkar (Internal Faculty)





**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.

BOS Members:

Dr. ReenaBharati(Subject Expert)

Dr. ManishaBharambe(Subject Expert)

Dr. JyotiYadav(Subject Expert)

Mr. Vishal Salke(Industry Expert)

Ms. AmrutaNambiar(Alumni)

Prof. AshwiniKulkarni (Chairman and Internal Faculty)

Prof. Smita Borkar (Internal Faculty)

Handwritten signatures in blue ink corresponding to the BOS members listed on the left. The signatures are: Dr. ReenaBharati, Dr. ManishaBharambe, Dr. JyotiYadav, Mr. Vishal Salke, Ms. AmrutaNambiar, Prof. AshwiniKulkarni, and Prof. Smita Borkar.



- 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 .

BOS Members:

Dr. ReenaBharati(Subject Expert)

Dr. ManishaBharambe(Subject Expert)

Dr. JyotiYadav(Subject Expert)

Mr. Vishal Salke(Industry Expert)

Ms. AmrutaNambiar(Alumni)

Prof. Ashwini Kulkarni (Chairman and Internal Faculty)

Prof. Smita Borkar (Internal Faculty)

- **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 3<sup>rd</sup> edition- *LISP* . (BPB Publication)
5. M. Gabbrielli, S. Martini, Springer *Programming Languages: Principles and Paradigms*, ISBN: 9781848829138.

BOS Members:

- Dr. ReenaBharati(Subject Expert)
- Dr. ManishaBharambe(Subject Expert)
- Dr. JyotiYadav(Subject Expert)
- Mr. Vishal Salke(Industry Expert)
- Ms. AmrutaNambiar(Alumni)
- Prof. AshwiniKulkarni (Chairman AND Internal Faculty)
- Prof. Smita Borkar (Internal Faculty)



Handwritten signatures in blue ink, including names like 'Reena', 'Manisha', 'Jyoti', 'Vishal', 'Amruta', and 'Ashwini'.

