

MSc Computer Science(2019-2024)
Paradigm of Programming Language

Semester I	Subject Code: MS11901	Lectures: 60
-------------------	------------------------------	---------------------

Learning Outcomes:

After successfully completing the course students will be able to

- develop an in-depth understanding of functional, logic, and object-oriented languages.
- analyze semantic issues associated with function implementations, including variable binding, scoping rules, parameter passing, and exception handling.
- be familiar with design issues of object-oriented and functional languages.
- be familiar with language abstraction constructs of classes, interfaces, packages, and procedures.
- understand the Scala programming language



MSc Computer Science Syllabus First Year (2019-2024)
Paradigm of Programming Language








Semester I	Subject Code: MS11901	Lectures: 60
-------------------	------------------------------	---------------------

Objectives:

The syllabus aims in equipping students with,

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

Unit 1: Introduction	02
Ch 1. Introduction to the programming languages <ul style="list-style-type: none"> • 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	10
Ch 2. Functional Programming in Scala <ul style="list-style-type: none"> • Strings • Numbers • Control Structures • Classes and Properties 	10

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)	



- Methods
- Objects
- Functional Programming
- List, Array, Map, Set

Unit 3: Scope and control flow in programming languages.

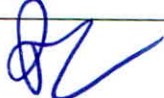
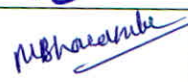
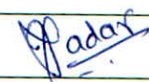


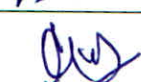

10

Ch 3. Names, Scopes, and Bindings

- The Notion of Binding Time
- 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.






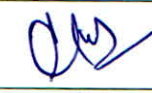

Ch 4. Control Flow

- Expression Evaluation
 - 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.
- Iteration and Recursion, Applicative- and Normal-Order evaluation.

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)	


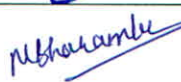
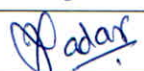






Unit 4: Datatypes	12
<ul style="list-style-type: none"> ➤ Ch 5. Datatypes • Primitive Data Types • Numeric Types <ul style="list-style-type: none"> ➤ Integer, Floating point, Complex, Decimal, Boolean Types, • Character Types • Character String Types <ul style="list-style-type: none"> ➤ Design Issues ➤ Strings and Their Operations ➤ String Length Operations ➤ Evaluation • Implementation of String types • User defined Ordinal types • Enumeration types <ul style="list-style-type: none"> ➤ Designs ➤ Evaluation • Subrange types <ul style="list-style-type: none"> ➤ Ada's design : Example ➤ Evaluation ➤ Implementation of used defined ordinal types • Array types <ul style="list-style-type: none"> ➤ 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 & implementation 	12

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)	



<ul style="list-style-type: none"> • Record type <ul style="list-style-type: none"> ➤ Definitions of records . ➤ References to record fields . ➤ Operations on records . ➤ Evaluation . ➤ Implementation of Record types . • Pointer and Reference Types. <ul style="list-style-type: none"> ➤ 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 <ul style="list-style-type: none"> ➤ Representation of pointers and references Solution to dangling pointer problem. 	
Unit 4: Subroutines and Control Abstraction	14
Ch 6 . Subroutines <ul style="list-style-type: none"> • Fundamentals of Subprograms Design Issues for subprograms . • Local Referencing Environments . • Parameter-Passing Methods . • Parameters that are Subprograms . • Overloaded Subprograms . • Generic Subroutines <ul style="list-style-type: none"> ➤ 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,Dynamic scope 	07

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)	









Ch 7. 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

07

References books

1. Kaufmann Publishers, An Imprint of Elsevier *Scott Programming Language Pragmatics*, ISBN 9788131222560.
2. Pearson Education Robert W. Sebesta, *Concepts of Programming*
3. O'Reilly Publication Alvin Alexander *Scala Cookbook*

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)	