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,

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Unit 1: Introduction	**02**
Ch 1. Introduction to the programming languages • 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 • 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)	

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• 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 WithinExpressions, ➢ 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.	

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Unit 4: Datatypes	12
➢ **Ch 5. Datatypes** • 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 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 & implementation	12

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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	**14**
Ch 6 . Subroutines • Fundamentals of Subprograms Design Issues for subprograms . • Local Referencing Environments . • Parameter-Passing Methods . • Parameters that are Subprograms . • Overloaded Subprograms . • **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,Dynamic scope	**07**

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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

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