Course: Major
Paradigm of Programming Languages

Semester: I	Credits: 4	Subject Code: SMAJCPPL123552	Lectures: 60

Course Outcomes:

At the end of this course, the learner will be able to:
- CO1-Learn major programming paradigms and techniques involved in design and implementation of modern programming languages.
- CO2-Design and develop programs using the Scala programming language.
- CO3-Analyze methodologies, design/implementation issuesinvolved with variable allocation and binding with respect to various programming languages.
- CO4-Understand the evolution of data types and subroutines.
- CO5- Understand the concept of object orientation.
- CO6 -Understand the concept of concurrent programming.

Unit 1:Introduction to the programming languages	**15**

- Introduction to the programming languages- History and need of various types of programming languages (PL), Types of programminglanguages, Characteristics of programming languages,Language Evaluation Criteria, Syntax, Semantics, Pragmatics Analysis of programming languages.
- Functional Programming in Scala-Strings,Numbers, Classes and properties, Methods, Objects, Functional Programming, List, Array, Map, Set.

Unit 2:Scope, Control flow in programming languages	**15**

- Scope -The Notion of Binding Time, Object Lifetime and Storage Management, Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection, ScopeRules, Static Scoping, Nested Subroutines, declaration order, Dynamic Scoping, meaning of Names in a Scope, Aliases, Overloading, Polymorphism and binding of Referencing Environments, Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures, Macro Expansion.
- Control flow-Expression Evaluation- Precedence and Associativity, Assignments, Initialization, ordering within Expressions, Short-Circuit Evaluation, Structured and Unstructured Flow-Structured Alternatives go to, Sequencing-Selection Short-Circuited Conditions, Case/Switch Statements, Iteration -Enumeration-Controlled Loops, Combination Loops, Iterators, Controlled Loops, Recursion, Applicative and Normal-Order evaluation.

Unit 3: Data types and Subroutines	**15**

- Datatypes-Primitive Data Types, Numeric Types-Integer, Floating point, Complex, Decimal, Boolean Types, CharacterTypes,Character String Types, DesignIssues, Strings and Their Operations, String Length Operations, Evaluation, Implementation of String types,
- User defined Ordinal types -Enumeration types, implementation of user defined ordinal types.
- Array types-Design issues, Arrays and indices, Subscript bindings and array categories, Heterogeneous arrays   , Arrayinitialization, Arrayoperations, Rectangular and Jagged arrays, Slices, Evaluation, Implementation of Array Types,
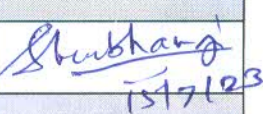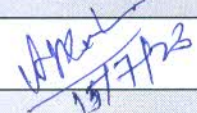
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Associative Arrays & implementation.
- Record type- Definitions of records, References to record fields, Operations on records,Evaluation, Implementation of Record types
- Pointer and Reference Types-Design issues, Pointeroperations, Pointerproblems, Dangling pointers, Solution to dangling pointer problem, Lost heap dynamic, variables, Comparison of Pointers in C and C++, Referencetypes, Evaluation, Implementation of pointer and reference types.
- Subroutines-Fundamentals of Subprograms,design Issues for subprograms, Local Referencing Environments,parameter, PassingMethods, Parameters that are Subprograms, OverloadedSubprograms,design Issues for Functions, User-Defined Overloaded Operators, Coroutines, General Semantics of Calls and Returns, Implementing Subprograms with Stack-Dynamic Local Variables, NestedSubprograms, Blocks, Dynamic scope.

Unit 4: Object Orientation and Concurrency	15

- Object-Oriented Programming-Encapsulation and Inheritance, Initialization and Finalization, Choosing a Constructor, References and Values, Execution Order, Garbage Collection, Dynamic Method Binding, Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup, Polymorphism, Object Closures, Multiple Inheritance
- Introduction to concurrent programming- Introduction to Concurrency, categories of concurrency, Subprogram-level, concurrency Fundamental concepts, Language design for concurrency, design Issues, Semaphores, Monitors, Introduction to Message Passing, concept of Synchronous Message Passing JavaThreads, The Thread class, Priorities

Reference Books:

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

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