Savitribai Phule Pune University
Second Year of Computer Science and Engineering in Data Science (2019 Course)
210243: Object Oriented Programming

Teaching Scheme:	Credit:	Examination Scheme:
TH: 03 Hours/Week	03	Mid_Semester(TH): 30 Marks End_Semester(TH): 70 Marks

Prerequisite Courses, if any: (1019107) Fundamentals of Programming Languages, (1431113) Programming and Problem Solving

Companion Course, if any: (1024206) OOP Laboratory

Course Objectives:

The course is intended to provide the foundations and in-depth understanding of a modern object- oriented language.

- To learn the object-oriented programming paradigm, use of classes along with the fundamentals of object-oriented design
- To learn the syntax and semantics of the C++ programming language.
- To understand the concept like data abstraction and encapsulation, how to design C++ classes for code reuse, how to implement copy constructors and class member functions, to overload functions and operators in C++.
- To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
- To learn how to design and implement generic classes with C++ templates and how to use exception handling in C++ programs.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software.

CO2: Design object-oriented solutions for small systems involving multiple objects.

CO3: Use virtual and pure virtual function and complex programming situations.

CO4: Apply object-oriented software principles in problem solving.

CO5: Analyze the strengths of object-oriented programming.

CO6: Develop the application using object-oriented programming language (C++).

Course Contents

Unit I	OOP Fundamentals	(07 Hours)

Introduction to object-oriented programming, need of object-oriented programming, Fundamentals of object-oriented programming: Namespaces, objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Benefits of OOP, C++ as object-oriented programming language.

C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, Access specifies, separating interface from implementation. Functions- Function, function prototype, accessing function and utility function, Constructors and destructor, Types of constructors, Objects and

Memory requirements, Static members: variable and functions, inline function, friend function.

#Exemplar/Case Studies	Story on C++ invention by Bjarne Stroustrup

Mapping of Course Outcomes for Unit I	CO1, CO5	
Unit II	**Inheritance and Pointers**	**(07 Hours)**
Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Public and Private Inheritance, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual Base Class, Abstract class, Friend Class, Nested Class. Pointers: declaring and initializing pointers, indirection Operators, Memory Management: new and delete, Pointers to Objects, this pointer, Pointers Vs Arrays, accessing Arrays using pointers, Arrays of Pointers, Function pointers, Pointers to Pointers, Pointers to Derived classes, passing pointers to functions, Return pointers from functions, Null pointer, void pointer.		
#Exemplar/Case Studies	popular software's developed using C++: Firefox and Thunderbird	
Mapping of Course Outcomes for Unit II	CO2, CO4	
Unit III	**Polymorphism**	**(07 Hours)**
Polymorphism- Introduction to Polymorphism, Types of Polymorphism, Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable. Function overloading, Run Time Polymorphism- Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class.		
#Exemplar/Case Studies	use of C++ SDKs wrappers for Java and .Net	
Mapping of Course Outcomes for Unit III	CO2, CO3, CO4	
Unit IV	**Files and Streams**	**(06 Hours)**
Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output.		
#Exemplar/Case Studies	Study of the features used for MS Office, Internet Explorer and Visual Studio.	
Mapping of Course Outcomes for Unit IV	CO2, CO4	
Unit V	**Exception Handling & Templates**	**(07 Hours)**
Exception Handling- Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, Multiple catching, re-throwing an exception, exception specifications, user defined exceptions, processing unexpected exceptions, constructor, destructor and exception handling, exception and inheritance. Templates- The Power of Templates, Function template, overloading Function templates, and class template, class template and non-type parameters, template and friends Generic Functions, The type name and export keywords**.**		
#Exemplar/Case Studies	Use of exception handling in Symbian Operating System (discontinued Mobile OS) that was developed using C++.	

Mapping of Course Outcomes for Unit V	CO2, CO4, CO6

Unit VI	**STL: Standard Template Library**	**(06 Hours)**

Introduction to STL, STL Components, Containers- Sequence container and associative containers, container adapters, Application of Container classes: vector, list,

Algorithms- basic searching and sorting algorithms, min-max algorithm, set operations, heap sort, Iterators- input, output, forward, bidirectional and random access. Object Oriented Programming — a road map to future.

#Exemplar/Case Studies	Study MySQL open source C++ code available at GitHub
Mapping of Course Outcomes for Unit V	CO2, CO4, CO6

Learning Resources

Text Books:

1. Deitel,"C++ How to Program", 4th Edition, Pearson Education, ISBN:81-297-0276-2
2. Robert Lafore, "Object-Oriented Programming in CHI", fourth edition, Sams Publishing, ISBN:0672323087

Reference Books:

1. Herbert Schildt, "C++-The complete reference"II, Eighth Edition, McGraw Hill Professional, 2011
2. Matt Weisfeld, "The Object-Oriented Thought Process", Third Edition Pearson
3. E.Balagurusamy, "Object-Oriented Programming with C++", Graw-Hill Publication
4. Cox Brad, Andrew J. Novobilski, "Object —Oriented Programming: An Evolutionary Approachl, Second Edition

MOOC Courses:

1. https://onlinecourses.nptel.ac.in/noc24_cs44/preview
2. https://www.classcentral.com/course/freecodecamp-object-oriented-programming-oop-in-c- course-104967
3. https://www.mygreatlearning.com/academy/learn-for-free/courses/oops-concepts-in-c

The CO-PO mapping table

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	-	-	-	-	-	-	-	-
CO2	1	2	1	1	-	-	-	-	-	-	-	1
CO3	2	1	2	2	-	-	-	-	-	-	-	-
CO4	2	1	2	1	-	-	-	-	-	-	-	1
CO5	-	1	-	1	-	-	-	-	-	-	-	-
CO6	-	-	1	-	-	-	-	-	-	-	-	1