A. Course Handout

Institute/School Name	Chitkara University Institute of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering		
Course Name	Object Oriented Programming	Session	2023-2024
Course Code	22CS006	Semester/Batch	3rd/2022
L-T-P (Per Week)	4-0-4	Course Credits	06
Course Coordinator	Dr. Heena Wadhwa		

CLO01	Understand C++ language features, basics of problem solving aspects for logic building by using data types, variables, operators and expressions.
CLO02	Choose the appropriate object oriented programming constructs to solve the problems using classes, objects, recursion and constructors.
CLO03	Apply inheritance, early binding and late binding in C++ to formulate new solutions for programming problems.
CLO04	Determine the bugs in a program using exceptional handling and recognize basic need of templates.
CLO05	Design and develop reusable and modular code for collaborative team based software development.

1. Objectives of the Course

The course provides a wide scope of learning & understanding of the subject. The main objectives of the course are :

- To formulate proficient solutions of programming problems using object oriented constructs.
- To demonstrate the importance of major features of object oriented programming such as encapsulation, inheritance, code extensibility, reusability, and polymorphism.
- To customize their own templates and implement the generic programming.
- To evaluate and improve the existing programs using Standard Template Library.

2. Course Learning Outcomes

After completion of the course, student should be able to:

Sr. No	Course Outcome	*POs	**CL	***KC	Sessions
CLO01	Understand C++ language features, basics of problem solving aspects for logic building by using data types, variables, operators and expressions.	PO1,PO2,PO4,PO5, PO9,PO12	K2	Factual Conceptual	22
CLO02	Choose the appropriate object oriented programming programming constructs to solve the problems using	PO1,PO2,PO4,PO5, PO12	K3	Conceptual Procedural	19

	classes, objects, recursion and constructors.				
CLO03	Apply inheritance, early binding and late binding in C++ to formulate new solutions for programming problems.	PO1,PO3,PO4,PO5, PO11,PO12	K4	Conceptual Procedural	18
CLO04	Determine the bugs in a program using exceptional handling and recognize basic need of templates.	PO1,PO3,PO5, PO10,PO11	K3	Procedural	20
CLO05	Design and develop reusable and modular code for collaborative team based software development	PO2,PO4,PO9, PO10,PO11	K4	Procedural	21
Total Contact Hours					100

Revised Bloom's Taxonomy Terminology

* PO's available at

**Cognitive Level =CL

***Knowledge Categories = KC

CLO-PO mapping grid |Program outcomes (POs) are available as a part of Academic Program Guide (APG)

Course Learning Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO01	H	L		M	H				M			M
CLO02	M	L	M	M	M							M
CLO03	L		M		M						L	M
CLO04	M		H		H						L	
CLO05		M		H					H	M	M	

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	**Level(1-5, 5 being highest)**
Entrepreneurship	2
Research	1
Innovation	3
Skills	5
Employability	4

4. Recommended Books:

Text Books:

B01: 'Object Oriented Programming with C++' by E Balagurusamy, 6th Edition, Tata McGraw Hill.
B02: Object Oriented Programming in C++' by Robert Lafore, 4th Edition, Galgotia.
B03: The Complete Reference C++' by Herbert Schildt , 4th Edition ,Tata McGraw Hill.
B04: Stroustrup, Bjarne, The C++ Programming Language, Pearson Education .
B05: Lippman, S.B. and Lajoie, J., C++Primer, Pearson Education .
B06: C-The Complete Reference, Herbert Schildt,4th edition, McGraw Hill Education, 2017
B07: The C Programming Language, Brian W. Kernighan, and Dennis M. Ritchie, 2nd Edition, Pearson, 2015

E-Resourses:

- https://library.chitkara.edu.in/subscribed-books.php
- https://www.sciencedirect.com/science/article/pii/B9780123507723500069?via%3Dihub

5. Other readings and relevant websites:

Serial No	Link of Journals, Magazines, websites and Research Papers
1.	http://www.cprogramming.com/tutorial/c++-tutorial.html
2.	http://www.cplusplus.com/doc/tutorial/
3.	http://www.tenouk.com/cncplusplustutorials.html
4.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/

6. Recommended Tools and Platforms

Code Blocks
GCC Compiler
Coding Ninjas

7. Course Plan:

Lecture Number	Topics	Text Book
1-5	Fundamental and problem solving aspect using C, Introduction to structures, typedef, pointers and nesting structures, functions, structures assignments and arrays, structure members alignment, padding and packing, bit Fields in C, union and enumeration, compilation process	B01,B06
6-9	File handling, pointer with const keyword , inline functions, function pointers, sorting using function pointers , sorting using qsort() in c, variable number of parameters in functions	B06,B07
10-14	Aadvanced concept-stacks using arrays, reverse string using stacks, balanced brackets, postfix evaluation, prefix evaluation and infix to postfix conversion, queues using arrays, circular queues	B06,B07
15-17	Introduction to basic concepts of object-oriented programming, procedural programming versus object oriented programming paradigm, structures versus classes, variables and data types in c++, console i/o, preprocessor directives	B01
18-20	Decision making (if, if-else, if- else-if ladder, switch case, go to), repetitive constructs (for, while, do-while, break, continue)	B01
ST-1 (Syllabus = (Lecture number 1-20) (Online Platform)		
21-23	Arrays (1d, 2d, multi dimensional), understanding pointers, accessing address of a variable, declaring & initializing pointers, accessing a variable through its pointer, pointer arithmetic, pointer to a pointer, accessing arrays using pointer	B01
24-26	Functions in c++ : inline functions, default arguments, function prototyping, function overloading.	B01

27-29	Dynamic memory management & pointers - new and delete operators, this pointer, possible problems with the use of pointers - dangling/wild pointers, null pointer assignment, memory leak and allocation failures	B01,B02
30-32	Recursion in c++: recap of recursion, recursion examples, order of execution	B01,B02
33-35	Direct & indirect recursion stack overflow, tail & non-tail recursion	B01
36-38	Classes and objects: oops paradigm and its features, specifying a class, creating class objects, accessing class members.	B01,B02
39-43	Access specifiers – public,private,and protected, objects and memory, static members, static objects, constant member function, constant objects, friend functions, friend class, passing object as an argument (by value, by reference and by address), returning object from a function.	B01,B02
ST-2 (Syllabus = (Lecture number 21-43) (Online Platform)		
44-48	Constructors and destructors: need for constructors and destructors, , constructor overloading, copy constructor, dynamic constructors, destructors, constructors and destructors with static members.	B01,B02
49-55	Operator overloading: defining operator overloading, rules for overloading operators, overloading of unary operators, binary operators(+,-,/,*), binary operators using friend functions, manipulation of strings using operators overloading(>,<,= =) , type conversion: basic type to class type, class type to basic type, class to class type.	B01,B02
56-60	Inheritance: introduction, defining derived classes, forms of inheritance(single, multilevel, multiple)	B01,B02
61-64	Hybrid & hierarchical inheritance, ambiguity in multiple and multipath inheritance	B01
65-68	Inheritance with constructor, overriding member functions, order of execution of constructors and destructors.	B01,B02
ST-3 (Syllabus = (Lecture number 44-68) (Online Platform)		
69- 70	Virtual base class, overriding member functions	B02
71-75	Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes	B02
76-79	Virtual destructors & polymorphism	B01,B02
80-84	Exception handling: review of traditional error handling, basics of exception handling,	B03, B04
85-87	Exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.	B04
88-90	Function templates, class templates, overloading of template functions.	B03
91-93	Introduction to the standard template library (containers, algorithms, iterators,vectors) : sequence container: vector(push_back(),pop_back(),back(),size(),empty()), list(push_front(),pop_front(),front(),size(),empty()) dequeue(push_back(),pop_back(),push_front(),pop_front(),size(),empty())	B03, B05
94-97	Associative container: set(insert(),erase(),size(),empty(),count(),clear()), multiset(insert(),erase(),size(),empty(),count(),clear()), map(insert(),erase(),size(),empty(),count(),clear()), multimap(insert(),erase(),size(),empty(),count(),clear())	B03, B05
98-100	Derived container: stack, queue, priority_queue, algorithms: count(),count_if(),find(),find_if(),copy(),fill(),remove(), remove_copy(), replace(), replace_copy(),reverse(),reverse_copy(), unique(),unique_copy(),max(), max_element(), min(),min_element(), iterators: input, output, forward, vectors:back(),begin(),clear(),empty(),end(), erase(),pop_back(),push_back()	B03, B05
ETE (Syllabus = (Lecture number 1-100) (Online Platform)		

8. Delivery/Instructional Resources

Lecture No.	Topics	Web References	Audio-Video
1-5	Fundamental and problem solving aspect using C, Introduction to Structures, typedef, pointers and nesting structures, functions, structures assignments and arrays, structure members alignment, Padding and Packing, Bit Fields in C, Union and Enumeration, compilation process	https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/	https://nptel.ac.in/courses/106105171
6-9	File Handling, Pointer with const keyword, Inline functions, function pointers, sorting using function pointers , sorting using qsort() in C, variable number of parameters in functions	https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/resources/mit6_087iap10_lec07/	https://nptel.ac.in/courses/106104128
10-14	Advanced concept-Stacks using arrays, Reverse string using stacks, balanced brackets, postfix evaluation, prefix evaluation and infix to postfix conversion, queues using Arrays, Circular queues	https://www.tutorialspoint.com/data_structures_algorithms/stack_program_in_c.htm	https://www.youtube.com/watch?v=VmsTAVpz0xo
15-17	Introduction to basic concepts of object-oriented programming, Procedural Programming versus Object Oriented Programming paradigm, Structures versus Classes, Variables and Data Types in C++, Console I/O, Preprocessor directives	https://www.cet.edu.in/noticefiles/285_OOPS%20lecture%20notes%20Complete.pdf https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/	https://onlinecourses.nptel.ac.in/noc19_cs39/preview https://www.youtube.com/watch?v=jVJwDy1zUUg https://www.youtube.com/watch?v=LZFoktwiars&list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY
18-20	Decision making (if, if-else, if- else-if ladder, switch case, go to), Repetitive Constructs (for, while, do-while, break, continue)	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/	https://www.youtube.com/watch?v=efXI8anQwXo&list=PLEAYkSg4uSQ2qzihjdDEseWrrY1DyxH9P
21-23	Arrays (1D, 2D, multi dimensional), Understanding pointers, Accessing address of a variable, Declaring & initializing pointers, Accessing a variable through its pointer, Pointer arithmetic, Pointer to a pointer, Accessing arrays using pointer	https://www.hackerearth.com/practice/algorithms/sorting/bubble-sort/visualize/ https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/	https://www.youtube.com/watch?v=Z_0xXmOgYtY https://www.youtube.com/watch?v=nAGjoysNM4s
24-26	Functions in C++ : Inline functions, Default arguments, Function prototyping, Function Overloading	https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/resources/mit6_096iap11_lec03/	https://www.youtube.com/watch?v=efXI8anQwXo&list=PLEAYkSg4uSQ2qzihjdDEseWrrY1DyxH9P

		https://www.w3schools.com/cpp/cpp_pointers.asp	https://www.youtube.com/watch?v=cVLw5HeL3JM
27-29	Dynamic memory management & Pointers - new and delete Operators, this Pointer, Possible problems with the use of pointers - Dangling/wild pointers, Null pointer assignment, Memory leak and allocation failures	https://www3.ntu.edu.sg/home/ehchua/programming/cpp/cp4_PointerReference.html https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/	https://www.youtube.com/watch?v=Z_0xXmOgYtY https://www.youtube.com/watch?v=nAGjoysNM4s
30-32	Recursion in C++: Recap of Recursion, Recursion Examples, Order of Execution	https://www.w3schools.com/cpp/cpp_functions_recursion.asp	https://www.youtube.com/watch?v=yVdKa8dnKiE&list=PLgUwDviBIf0rGlzIn_7rsaR2FQ5e6ZOL9
33-35	Direct & Indirect Recursion Stack Overflow, Tail & Non-tail Recursion	https://www.w3schools.com/cpp/cpp_functions_recursion.asp	https://www.youtube.com/watch?v=yVdKa8dnKiE&list=PLgUwDviBIf0rGlzIn_7rsaR2FQ5e6ZOL9
36-38	Classes and Objects: Object Oriented Programming Paradigm and its features, Specifying a class, Creating class objects, Accessing class members.	https://www.cse.iitb.ac.in/~cs101/2019.1/lectures/Lecture20.pdf	https://www.youtube.com/watch?v=i_5pvt7ag7E
39-43	Access specifiers – public,private,and protected, Objects and memory, Static members, Static objects, Constant member function, Constant objects, Friend functions, Friend class, Passing Object as an argument (by value, by reference and by address), Returning object from a function.	https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/	https://www.youtube.com/watch?v=i_5pvt7ag7E
44-48	Constructors and Destructors: Need for constructors and destructors, , Constructor overloading, Copy constructor, Dynamic constructors, Destructors, Constructors and destructors with static members.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes	https://www.youtube.com/watch?v=uIjgl6qBfFc https://www.youtube.com/watch?v=oRBK0Mh_gG0
49-55	Operator Overloading: Defining operator overloading, Rules for overloading operators, Overloading of unary operators, Binary operators(+,-,/,*), Binary operators using friend functions, Manipulation of strings using operators Overloading(>,<,==) , Type conversion: Basic type to class type, Class type to basic type, Class to class type.	https://www3.ntu.edu.sg/home/ehchua/programming/cpp/cp4_PointerReference.html https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/	https://www.youtube.com/watch?v=Z_0xXmOgYtY https://www.youtube.com/watch?v=nAGjoysNM4s
56-60	Inheritance: Introduction, Defining derived classes, Forms of Inheritance(single, multilevel, multiple)	https://www.w3schools.in/cplusplus-tutorial/inheritance/	https://www.youtube.com/watch?v=jflvIa60EAg

61-64	Hybrid & hierarchical inheritance, ambiguity in multiple and multipath inheritance	https://www.w3schools.in/cplusplus-tutorial/inheritance/	https://www.youtube.com/watch?v=jflvIa60EAg
65-68	Inheritance with constructor, Overriding member functions, Order of execution of constructors and destructors.	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fjpwebdevelopers.in%2Fppts%2Finheritance.pptx&wdOrigin=BROWSELINK	https://www.youtube.com/watch?v=8fDao3MBbwk
69- 70	Virtual base class, Overriding member functions	https://www.w3schools.in/cplusplus-tutorial/polymorphism/	https://www.youtube.com/watch?v=jflvIa60EAg
71-75	Concept of Binding - Early binding and late binding, Virtual functions, Pure virtual functions, Abstract classes	https://www.w3schools.in/cplusplus-tutorial/polymorphism/	https://www.youtube.com/watch?v=jflvIa60EAg
76-79	Virtual destructors & polymorphism	https://www.geeksforgeeks.org/virtual-destructor/	https://www.youtube.com/watch?v=DJS9eSN4jAc
80-84	Exception Handling: Review of traditional error handling, Basics of exception handling,	https://www.coursehero.com/file/129688644/Lecture-9-Exception-handlingppt/	https://www.youtube.com/watch?v=-frZ8btNBSU
85-87	Exception handling mechanism, Throwing mechanism, Catching mechanism, Rethrowing an exception, Specifying exceptions.	https://www.coursehero.com/file/129688644/Lecture-9-Exception-handlingppt/	https://www.youtube.com/watch?v=-frZ8btNBSU
88-90	Function templates, Class templates, Overloading of template functions.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/MIT6_096IAP11_lec09.pdf https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/MIT6_096IAP11_lec09.pdf	https://www.youtube.com/watch?v=zjXso3X2jms https://www.youtube.com/watch?v=zjXso3X2jms
91-93	Introduction to the Standard Template Library (Containers, Algorithms, Iterators) : Sequence Container: vector(push_back(),pop_back(),back(),size(),empty()), list(push_front(),pop_front(),front(),size(),empty()) dequeue(push_back(),pop_back(),push_front(),pop_front(),size(),empty())	https://www.geeksforgeeks.org/cpp-stl-tutorial/ https://courses.cs.washington.edu/courses/cse333/18su/lectures/14-c++-STL.pdf	https://www.youtube.com/watch?v=W7uB9-TKfTg
94-97	Associative Container: set(Insert(),erase(),Size(),Empty(),Count(),Clear()), multiset(Insert(),erase(),Size(),Empty(),Count(),Clear()), map(Insert(),erase(),Size(),Empty(),Count(),Clear()), multimap(Insert(),erase(),Size(),Empty(),Count(),Clear())	https://www.geeksforgeeks.org/cpp-stl-tutorial/	https://www.youtube.com/watch?v=W7uB9-TKfTg

98-100	Derived Container: stack, queue, priority_queue, ALGORITHMS: count(),count_if(),find(),find_if(),copy(),fill(),remove(), remove_copy(), replace(), replace_copy(),reverse(),reverse_copy(), unique(),unique_copy(),max(), max_element(), min(),min_element(), iterators: input, output, forward, vectors:back(),begin(),clear(),empty(),end(), erase(),pop_back(),push_back()	https://www.geeksforgeeks.org/cpp-stl-tutorial/	https://www.youtube.com/watch?v=W7uB9-TKfTg

9. Action plan for different types of learners

Slow Learners	Average Learners	Fast Learners
Remedial Classes Doubt Sessions Guided Tutorials Use of audio and visual material	Pre-coded algorithms to illustrate concepts E-notes and E-exercises to read ahead of the pedagogic material	Design solutions for complex problems Coding Competitions, Project

10. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 1	Sessional Tests (STs)	03**	40%	Online platform
Component 2	End Term Examination	01***	60%	Online platform
Total		**100%**		

**Out of 03 STs, the ERP system automatically picks the best 02 ST.
***As per Academic Guidelines minimum 85% attendance is required to become eligible for appearing in the End Semester Examination.

11. Syllabus of the Course:

S.No.	Topic (s)	No. of Sessions	Weightage %
1	Fundamental and problem-solving aspect using C, Introduction to Structures, typedef, pointers and nesting structures, functions, structures assignments and arrays, structure members alignment, Padding and Packing, Bit Fields in C, Union and Enumeration, compilation process File Handling, Pointer with const keyword, Inline functions, function pointers, sorting using function pointers, sorting using qsort() in C, variable number of parameters in functions, Advanced concept-Stacks using arrays, Reverse string using stacks, balanced brackets, postfix evaluation, prefix evaluation and infix to postfix conversion, queues using Arrays, Circular queues Introduction to basic concepts of object-oriented programming, Procedural Programming versus Object Oriented Programming paradigm, Structures versus Classes, Variables and Data Types in C++, Console I/O, Preprocessor directives	**20**	**27%**

	Decision making (if, if-else, if- else-if ladder, switch case, go to), Repetitive Constructs (for, while, do-while, break, continue)		
	ST-1 (Covering 27% syllabus)		
2	Arrays (1D, 2D, multi-dimensional), Understanding pointers, accessing address of a variable, Declaring & initializing pointers, accessing a variable through its pointer, Pointer arithmetic, Pointer to a pointer, accessing arrays using pointer, Pointer Arithmetic in C++, Pointer Arithmetic with Pointers Functions in C++: Inline functions, Default arguments, Function prototyping, Function Overloading, Parameter passing techniques, Dynamic memory management & Pointers - new and delete Operators, this Pointer, Possible problems with the use of pointers - Dangling/wild pointers, Null pointer assignment, Memory leak and allocation failures Recursion in C++: Recap of Recursion, Recursion Examples, Order of Execution, direct & Indirect Recursion Stack Overflow, Tail & Non-tail Recursion Classes and Objects: OOps Paradigm and its features, specifying a class, Creating class objects, Accessing class members. Access specifiers – public, private, and protected, Objects and memory, Static members, Static objects, Constant member function, Constant objects, Friend functions, Friend class, Passing Object as an argument (by value, by reference and by address), Returning object from a function.	**23**	**27%**
	ST-2 (Covering 27% syllabus)		
3	Constructors and Destructors: Need for constructors and destructors, Constructor overloading, Copy constructor, Dynamic constructors, Destructors, Constructors and destructors with static members. Operator Overloading: Defining operator overloading, Rules for overloading operators, overloading of unary operators, Binary operators (+, -, /, *), Binary operators using friend functions, Manipulation of strings using operators overloading (>, <, = =), Type conversion: Basic type to class type, Class type to basic type, Class to class type. I nheritance: Introduction, Defining derived classes, Forms of Inheritance (single, multilevel, multiple) Hybrid & hierarchical inheritance, ambiguity in multiple and multipath inheritance. Inheritance with constructor, Overriding member functions, Order of execution of constructors and destructors.	**23**	**25%**
	ST-3 (Covering 25% syllabus)		
4	Virtual base class, Overriding member functions Concept of Binding - Early binding and late binding, Virtual functions, Pure virtual functions, Abstract classes Virtual destructors & polymorphism Exception Handling: Review of traditional error handling, Basics of exception handling, Exception handling mechanism, Throwing mechanism, Catching mechanism, Rethrowing an exception,		

	Specifying exceptions. Function templates, Class templates, Overloading of template functions. Introduction to the Standard Template Library Containers, Algorithms, Iterators,Vectors) : Sequence Container: vector(push_back(),pop_back(),back(),size(),empty()), list(push_front(),pop_front(),front(),size(),empty()) dequeue(push_back(),pop_back(),push_front(),pop_front(),size(),empty()) Associative Container: set(Insert(),erase(),Size(),Empty(),Count(),Clear()), multiset(Insert(),erase(),Size(),Empty(),Count(),Clear()), map(Insert(),erase(),Size(),Empty(),Count(),Clear()), multimap(Insert(),erase(),Size(),Empty(),Count(),Clear()) Derived Container: stack, queue, priority_queue, ALGORITHMS: count(),count_if(),find(),find_if(),copy(),fill(),remove(), remove_copy(), replace(), replace_copy(), reverse(), reverse_copy(), unique(),unique_copy(), max(), max_element(), min(),min_element(), iterators: input, output, forward, vectors:back(),begin(),clear(), empty(),end(), erase(),pop_back(),push_back()		
End Term Examination will be based on 100% syllabus.			

This Document is approved by:

Designation	**Name**	**Signature**
Course Coordinator	Dr. Heena Wadhwa	
Head-Academic Delivery	Dr. Vikas Khullar / Dr. Tanya Gera	
Dean	Dr. Rishu Chhabra	
Date (DD/MM/YYYY)	28.06.2023	