

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

B.Tech. - III Semester (CSE, ECE) | T2 EXAM - OCTOBER 2025

COURSE CODE (CREDITS): 18B11CI311 (3)

MAX. MARKS: 25

COURSE NAME: Object-Oriented Systems and Programming

MAX. TIME: 90 Min.

COURSE INSTRUCTORS: A. Kumar, A. Sharma, D. Gupta (Coord.), E. Puthooran, H. Singh, N. Singla, R. Sharma.

Note: 1) All questions are compulsory. Marks and COs for each question are indicated. 2) Answer the questions in the given order. 3) Be concise and write neatly.

Q. No.	Question	CO	Marks
Q. 1	Consider a class Box with private data members length and width. a) Declare a friend function displayArea that can access the private members of Box and print the area of a box. b) Overload the friend function displayArea so that it can either accept a single Box object or two Box objects, and print their area(s) accordingly.	1, 2	[3]
Q. 2	Design a C++ class named BrowserHistory that simulates the functionality of a web browser's history using a stack data structure implemented as an array of fixed size 10. The class should include the following features which must be demonstrated in main() method: a) Operator Overloading: Overload the += operator to add (push) a new URL string into the history stack. b) Conversion Function: Define a conversion operator operator int() that returns the current number of URLs stored in the history.	2	[3]
Q. 3	Write a program that reads a text file (INPUT.txt) containing one word per line (Sample of text file is provided below), reverses the words and then store them in another file called OUTPUT.txt. Sample INPUT.txt file INDIA AMERICA Sample OUTPUT.txt file AIDNI ACIREMA	2	[3]
Q. 4	In C++ multiple inheritance, Teacher and Researcher both publicly inherit from Person, and Professor inherits publicly from both Teacher and Researcher. When a Professor object accesses members of Person, ambiguity arises. a) What is the term used to describe this problem? Explain the cause of this issue in the given class hierarchy. b) Write a code snippet showing how to resolve this ambiguity.	2	[3]

Q. 5	Justify the following three rules with a single C++ program: - The pointers to objects of a derived class are type compatible with pointers to objects of the base class. - The compiler ignores the contents of the pointer and chooses the member function that matches the type of the pointer. - The compiler selects the function based on the contents of the pointer, not on the type of the pointer.	2	[3]
Q. 6	In C++, a class becomes abstract when it contains at least one pure virtual function. Now consider a scenario where an abstract base class contains a pure virtual destructor. Answer the following: - Why would a programmer declare a pure virtual destructor in an abstract base class? - Even though the destructor is pure virtual, what additional requirement must the programmer fulfill? - Write a C++ program that demonstrates the correct use of a pure virtual destructor and shows the order of destructor calls when deleting a derived class object through a base class pointer.	2	[3]
Q. 7	Provide clear and insightful theoretical explanations for the following topics: - File pointers and modes: i) seekg (n, ios:cur) ii) ios::ate - In C++, most operators can be overloaded, but a few such as ::, .., *, sizeof, and typeid, cannot. Explain why these operators are restricted, considering language design and semantics, and discuss how this ensures type safety, memory integrity, and consistent program behavior. - Explain how the vptr and vtable affect the size and memory layout of objects in C++, considering single, multiple, and virtual inheritance. - In C++, assigning a derived class object to a base class object can lead to object slicing. Explain what object slicing is and discuss under what circumstances it can be avoided in an inheritance hierarchy.	1, 2	[1, 2, 2, 2]