Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Electronics & Computer Engg./**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ IH/ TE**
Semester	**: Third**
Course Title	**: OBJECT ORIENTED PROGRAMMING USING C++**
Course Code	**: 313304**

I. RATIONALE

In the modern world of Information Technology, Object Oriented Programming provides the most preferred approach for software development. It offers a powerful way to cope up with real world problems. C++ helps to develop fundamental understanding of object oriented concepts. This course enables to implement object oriented approach to solve a given programming problem.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using concepts of OOP in C++.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Write C++ programs using classes and objects.
- CO2 - Develop C++ programs using constructors.
- CO3 - Implement Inheritance in C++.
- CO4 - Implement Polymorphism in C++.
- CO5 - Develop C++ programs to perform file operations.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313304	OBJECT ORIENTED PROGRAMMING USING C++	OOP	SEC	3	2	4	1	10	5	3	30	70	100	40	50	20	25@	10	25	10	200

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare POP vs OOP approach of programming. TLO 1.2 Describe the different features of Object Oriented Programming. TLO 1.3 Write programs to solve arithmetic expressions. TLO 1.4 Write programs to demonstrate use of special operators in C++. TLO 1.5 Develop C++ program to show the use of Classes and Objects.	**Unit - I Principles of Object Oriented Programming** 1.1 Procedure Oriented Programming (POP) verses Object Oriented Programming (OOP) 1.2 Features of Object Oriented Programming, Examples of Object Oriented languages, Applications of OOP 1.3 Data types, Type compatibility, Declaration of variable, Dynamic initialization of variable, Reference variable, Type casting 1.4 Special Operators in C++: Scope resolution operator, Memory management operators, Manipulators 1.5 Structure of C++ program, Basic Input /Output operators and functions in C++, Simple C++ Program 1.6 Class & Object: Introduction, Specifying a class, Access specifiers, Defining member functions: Inside class and Outside class, Creating objects, Memory allocations for objects	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
2	TLO 2.1 Develop a program using inline function. TLO 2.2 Develop friend function to solve given problem. TLO 2.3 Write C++ programs using array of objects. TLO 2.4 Write C++ program to initialize the object using constructor. TLO 2.5 Write C++ program to delete object using destructor.	**Unit - II Functions and Constructors** 2.1 Inline function, Static data members, Static member function, Friend function: Using two different classes , Using non-member function 2.2 Array of Objects, Object as function arguments 2.3 Concepts of Constructors, Types of constructors 2.4 Constructor overloading and Constructors with default arguments 2.5 Destructors	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the given type of inheritance based on its characteristics. TLO 3.2 Implement given type of inheritance in C++ program. TLO 3.3 Write C++ program using virtual base class. TLO 3.4 Use constructor in given derived class.	**Unit - III Extending classes using Inheritance** 3.1 Introduction to Inheritance, Defining a derived class, Visibility modes and effects 3.2 Types of Inheritance : Single, Multilevel, Multiple, Hierarchical, Hybrid 3.3 Virtual base class, Abstract class, Constructor in derived class	Lecture Using Chalk-Board, Demonstration, Presentations, Hands-on, Flipped Classroom.
4	TLO 4.1 Create C++ program to perform given arithmetic operations using pointers. TLO 4.2 Use 'pointer to object' to solve the given problem. TLO 4.3 Use compile time polymorphism to solve the given problem. TLO 4.4 Use run time polymorphism to solve the given problem.	**Unit - IV Pointers and Polymorphism in C++** 4.1 Concept of Pointer: Pointer declaration, Pointer operator, Address operator, Pointer arithmetic 4.2 Pointer to Object: Pointer to object, 'this' pointer, Pointer to derived class 4.3 Introduction of Polymorphism, Types of polymorphism 4.4 Compile time Polymorphism: Function overloading, Revision of constructor overloading, Operator overloading: Rules for operator overloading, Overloading of unary and binary operators 4.5 Run time polymorphism: Virtual function, Rules for virtual function, Pure virtual function	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.
5	TLO 5.1 Identify relevant class to perform the given file operations. TLO 5.2 Describe different file modes. TLO 5.3 Develop C++ program to perform read/write operations from/to the given file.	**Unit - V File operations** 5.1 C++ stream classes, Classes for file stream operations 5.2 Detection of end of file, File modes 5.3 Opening files: Using constructors and open(), Closing files, Reading from and writing to files, Formatted Input/output functions in file 5.4 Types of file: Random access, Sequential access	Lecture Using Chalk-Board, Presentations, Demonstration, Hands-on, Flipped Classroom.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Develop program to evaluate expressions using various operators and Input/output functions.	1	*Write programs to evaluate any expression using Input / Output functions	2	CO1
LLO 2.1 Develop C++ program using special type of operators.	2	*Write programs using- • Scope resolution operator • Memory management operator • Manipulators	4	CO1
LLO 3.1 Develop programs to implement type casting.	3	Write programs to demonstrate use of- • Implicit type casting • Explicit type casting	2	CO1
LLO 4.1 Implement classes and objects to define the function inside class.	4	Write programs to show use of classes and objects to define the function inside the class	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Implement classes and objects to define the function outside class.	5	*Write programs to define the function outside the class	2	CO1
LLO 6.1 Implement programs using inline function.	6	*Write programs to implement inline function	2	CO2
LLO 7.1 Implement friend function using different classes. LLO 7.2 Implement friend function using external function.	7	*Write programs to implement friend function using- • Two different classes • External function	2	CO2
LLO 8.1 Develop program using static data member. LLO 8.2 Develop program using static member function.	8	*Write programs to implement- • Static data member • Static member function	2	CO2
LLO 9.1 Implement programs to show the use of array of objects.	9	*Write programs to create array of objects	2	CO2
LLO 10.1 Implement the concept of constructor and destructor.	10	*Write programs for- • Default constructor • Parameterized constructor • Copy constructor • Multiple constructor in one class	4	CO2
LLO 11.1 Implement Single level inheritance. LLO 11.2 Implement multilevel inheritance.	11	Write programs using- • Single level inheritance • Multilevel inheritance	2	CO3
LLO 12.1 Develop program using multiple inheritance.	12	*Write programs to implement multiple inheritance	2	CO3
LLO 13.1 Develop program using hierarchical inheritance.	13	Write programs to implement hierarchical inheritance	2	CO3
LLO 14.1 Implement virtual base class in a program.	14	*Write programs to implement virtual base class.	2	CO3
LLO 15.1 Implement constructors in derived class in a program.	15	Write programs which show the use of constructors in derived class	2	CO3
LLO 16.1 Implement pointer arithmetic in a program. LLO 16.2 Implement pointer to object in a program. LLO 16.3 Implement 'this' pointer in a program.	16	*Write programs to implement- • Pointer to object • 'this' pointer	2	CO4
LLO 17.1 Implement program to use pointer to derived class.	17	*Write programs for- • Pointer to derived class in single inheritance • Pointer to derived class in multilevel inheritance	4	CO4
LLO 18.1 Implement function overloading in a program.	18	Write programs which show the use of function overloading	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Implement unary operator overloading using member function. LLO 19.2 Implement unary operator overloading using friend function.	19	*Write programs to overload unary operator using- • Member function • Friend function	4	CO4
LLO 20.1 Implement binary operator overloading using member function. LLO 20.2 Implement binary operator overloading using friend function.	20	Write programs to overload binary operator using- • Member function • Friend function	2	CO4
LLO 21.1 Develop program using virtual function.	21	*Write programs to implement virtual function	2	CO4
LLO 22.1 Develop program using pure virtual function.	22	Write programs to implement pure virtual function	2	CO4
LLO 23.1 Implement read and write operations from/to file using constructor. LLO 23.2 Implement read and write operations from/to file using open().	23	*Write programs to read and write from/to file using- • Constructor • open()	2	CO5
LLO 24.1 Use formatted Input / Output functions to format the contents.	24	*Write programs to copy the content of one file into another file using formatted input/output functions	2	CO5
LLO 25.1 Implement get() and put() functions on file.	25	Write file programs to implement sequential input and output operations on file	2	CO5
LLO 26.1 Implement input/ output operations on binary file.	26	Write programs to perform input / output operations on binary files	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop Student Grading System. Accept student data and marks for 5 subjects for 5 students. Calculate the percentage and finalize grade awarded to the student. Write the records in to file.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in file along with student credentials.
- Develop advanced calculator for the following function: Binary to Decimal, Decimal to Binary etc..
- Develop Hotel Management Application. It should accept room reservation for 10 rooms. Find number of empty rooms. Display relevant information and write maximum 5 records into file.
- Develop Employee Management System using Inheritance. Collect following information from user: Employee_ID ,Employee_Name, Basic_Salary, Leave taken in the month Calculate Net Salary assuming applicable deductions and display. Write maximum 5 records into file.
- Any other micro project as suggested by subject faculty.

Assignment

- Solve assignment covering all COs given by teacher

Other

- Complete the course object oriented concepts using C++ on Infosys Springboard

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System (Any computer system with basic configuration)	All
2	"C++" Compiler (Any)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Principles of Object Oriented Programming	CO1	8	2	4	6	12
2	II	Functions and Constructors	CO2	12	2	4	10	16
3	III	Extending classes using Inheritance	CO3	9	2	4	10	16
4	IV	Pointers and Polymorphism in C++	CO4	10	2	4	10	16
5	V	File operations	CO5	6	0	4	6	10
Grand Total				**45**	**8**	**20**	**42**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators
- Each practical will be assessed considering 60% weightage to process and 40% weightage to product
- A continuous assessment-based term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	2	1	1	1			
CO2	2	1	1	2	1	1	1			
CO3	2	2	2	2	2	2	1			
CO4	2	2	2	2	2	2	1			
CO5	2	2	2	2	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Object Oriented Programming with C++	McGraw-Hill Education ISBN-10:0070669074, ISBN-13:9780070669079
2	D Ravichandran	Programming with C++	McGraw-Hill Education ISBN-10: 0070681899, ISBN-13: 978-0070681897
3	Stroustrup B.	The C++ Programming Language	Pearson Education New Delhi ISBN-10: 0275967301, ISBN-13: 978-0275967307
4	Robert Lafore	Object Oriented Programming in C++	Pearson Education India ISBN-10: 8131722821, ISBN-13: 978-8131722824

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.w3schools.com/cpp/	C++ Tutorial for all topics
2	https://www.javatpoint.com/cpp-tutorial	C++ Tutorial for all topics
3	https://www.javatpoint.com/cpp-files-and-streams	C++ File Streams
4	https://www.programiz.com/cpp-programming	Inheritance in C++
5	https://www.programiz.com/cpp-programming/online-compiler/	Online Compiler for C++
6	https://www.onlinegdb.com/online_c++_compiler	Online compiler for C++

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students