

PSN College of Engineering and Technology (Autonomous) Tirunelveli - 627152



Course File

Subject Code : CS630202

Subject Name : DATA STRUCTURE USING C++

Regulation : REGULATION 2022

Semester : III

Academic Year : 2023 - 2024

Department : COMPUTER SCIENCE AND ENGINEERING

Degree & Programme : B.E. COMPUTER SCIENCE AND ENGINEERING

Prepared By

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Designation : Assistant Professor

Department : Computer Science and Engineering

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COURSE PLAN

R- 2022

Subject Name & Code	DATA STRUCTURE USING C++ & CS630202
Course Type	THEORY
Programme	B. E Computer Science and Engineering
Year/ Semester/ Section	II/ III/B
Nature of Course / Credit	Theory / 3
Course Coordinator	A.ENITHA

VISION AND MISSION OF THE INSTITUTE:

Institution Vision	Emerge as a pioneer institute inculcating engineering education and skills, research, values and ethics.	
Institution Mission	IM-1	To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices.
	IM-2	To develop the state of art infrastructure to meet the demands of technological revolution.
	IM-3	To improve and foster research in all dimensions for betterment of society.
	IM-4	To develop individual competencies to enhance employability and entrepreneurship in students.
	IM-5	To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace.

VISION AND MISSION OF THE DEPARTMENT:

Department Vision	To emerge as a preeminence program to produce quality Computer Science and Engineering graduates	
Department Mission	DM-1	To enhance professional and entrepreneurial skills through industry institute interaction to enable them in getting better placement
	DM-2	To promote research and continuing education
	DM-2	To train the students according to their discipline to meet dynamic needs of the society

1. PRE REQUISITES

Basic Concepts in C++

2. COURSE DESCRIPTION

This course provides an Object-oriented programming (OOP) is a programming paradigm based on the concept of objects, which are data structures that contain data, in the form of fields (or attributes) and code, in the form of procedures, (or methods) and also provide a Data Structure is a storage that is used to store and organize data. It is a way of arranging data on a computer so that it can be accessed and updated efficiently. A data structure is not only used for organizing the data. It is also used for processing, retrieving, and storing data.

3. CARRIER OPPORTUNITIES

- Computer Programmer
- Senior Software Engineer
- Software Development Engineer
- Backend Engineer

4. SYLLABUS

CS630202	DATA STRUCTURE USING C++				
Semester: III					
		L	T	P	C
		3	0	0	3
Programme: BE CSE		Category : CS			
COURSE OBJECTIVES:					
• To understand the basic concepts of OOPS and basic constructs in C++ • To learn how to define classes, objects, statements and constructors in C++ • To understand the concepts of operator overloading and inheritance in C++ • To understand the concepts of linear data structures and sorting • To understand the basic concepts of related to operating systems and computer networks					
UNIT 1: INTRODUCTION TO OOPS AND C++					9
Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – A simple C++ program - Basics of C++: Tokens – Keywords – Identifiers and constants – Basic data types - Declaration of variables – Operators in C++ – Scope resolution operator – Operator precedence.					
UNIT 2: CONTROL STRUCTURES AND STATEMENTS IN C++					9
Control structures in C++: if statement – switch statement – do-while statement – while statement – else statement - for statement - Functions in C++: Introduction - The main function – Function prototyping – Call by reference – Return by reference – Inline functions - Method overloading – friend and virtual functions – Math library functions.					
UNIT 3: BASIC OOPS CONCEPTS IN C++					9

Specifying a class – Defining member functions – A C++ program with class – Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Copy constructor – Destructors - Operator overloading – Inheritance - Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance.

UNIT 4: BASIC DATA STRUCTURES AND SORTING **9**

Algorithm – Analysis – List ADT – Stack ADT – Queue ADT – Priority Queue – Stack implementation – Basic operations on stack – Application of stack – Queue: Introduction – Definition of Queue – implementation of Queue – Operation on a Queue – Applications of Queue – Sorting : bubble sort-Insertion sort - Merge sort - Quick sort-Searching - hashing

UNIT 5: GRAPH AND TREES **9**

Trees: Introduction – Tree – Basic elements of a tree – Binary tree – Representation of binary tree – Operations on binary tree – AVL Tree – Operations on AVL Tree - Graph: Representation - Shortest path algorithm: Dijkstra's algorithm - Minimum spanning tree: Prim's Algorithm

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course, the student will be able to,

CO1: Understand the difference between object oriented programming and procedural oriented language and data types in C++

CO2: Implement C++ programs with features such as composition of objects, Polymorphism.

CO3: Implement C++ programs with features such as Operator overloading and inheritance

CO4: Choose an appropriate data structure for a particular problem

CO5: Simulate problems in the subjects like Operating system, Computer networks and also real world problems in C++

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2								1	2		
CO2	2	1	1									1		
CO3	1	2	2								2	1		
CO4	2	1	1								1	2		
CO5	2	2	2									1		

1- low, 2 - medium, 3 - high, '-' no correlation

TEXT BOOKS:

1.E.Balagurusamy, “Object Oriented Programming with C++”, Fifth Edition, Tata McGraw Hill, 2011 (Unit I,II and III)

2.Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Third edition, Pearson Education Asia, 2010. (Unit IV and V)

3. D.S.Malik, “ Data Structures using C++”, Second Edition,2010.

REFERENCE BOOKS:

1.M.T. Somashekara, Programming In C++, PHI Pvt. Ltd., 2008

2.B.Trivedi, Programming with ANSI C++, Oxford University Press, 2007

3. Rajesh K. Shukla, “Data Structures using C & C++”,2019.

WEB RESOURCES:

1.<https://www.edx.org/course/data-structures-algorithms-using-c>

2.<https://www.includehelp.com/c-programming-data-structure-examples.aspx>

5. COURSE OUT COMES		
CO's	CO - STATEMENTS	PO's
CO.1	Understand the difference between object oriented programming and procedural oriented language and data types in C++	1,2,3,11,12
CO.2	Implement C++ programs with features such as composition of objects, Polymorphism.	1,2,3,12
CO.3	Implement C++ programs with features such as Operator overloading and inheritance	1,2,3,11,12
CO.4	Choose an appropriate data structure for a particular problem	1,2,3,11,12
CO.5	Simulate problems in the subjects like Operating system, Computer networks and also real world problems in C++	1,2,3,12

6. INSTRUCTIONAL LEARNING OUTCOMES (Unitwise/assignments/tutorials)

Unit	Assessment Procedure
I	The outcome will be assessed through assignment, Class test , MCQ Test and CAT-1.
II	The outcome will be assessed through assignment, Class test , MCQ Test and CAT-1
III	The outcome will be assessed through assignment, Class test , MCQ Test and CAT-2.
IV	The outcome will be assessed through assignment, Class test , MCQ Test and CAT-2
V	The outcome will be assessed through assignment, Class test , MCQ Test and CAT – 3

7. PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

S. NO	TOPIC	PEOS
PEO1	Fundamental Knowledge	To impart Knowledge on the fundamental principles of mathematics, science, and sub-disciplines in the field of Engineering
PEO2	Career Development	To make them undergo industrial training, and Professional development courses inculcating the habit of perpetual learning for career development.
PEO3	Social Identity	To develop effective communication skills and make them socially responsible to work cooperatively in all environments.

8. PROGRAM OUTCOMES [PO's]

PO'S NO	KNOWLEDGE	STATEMENTS	APPLIANC E
1	Engineering Knowledge:	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Theory/ Practical / Project work
2	Problem Analysis:	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	Theory / Practical / Projects
3	Design / Development of Solutions:	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	Theory / Practical / Projects
4	Conduct Investigations of Complex Problems:	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Theory / Practical
5	Modern Tool usage:	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an UN 2 of the limitations.	Theory / Practical / Project work
6	The Engineer and Society:	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	Theory / Industrial visit / In plant training
7	Environment and Sustainability:	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Theory / Industrial Visit/ In plant Training

8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Theory / Industrial visit / In plant Training
9	Individual and Team Work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Projects
10	Communication:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Projects/ Seminar/ Mini Project
11	Project Management and Finance:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Projects
12	Life-long Learning:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Projects / Higher Studies

9. PROGRAMME SPECIFIC OBJECTIVE (PSO's)

PSO1	Proficient and Innovative with a strong cognizance in the IOT, through the Application of acquired knowledge and skills.
PSO2	Design and Implement IOT based solutions for improving operational efficiency by investigating existing industrial environment.

10. CO ,PO and PSO mapping (3 point scale)

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	2	2								1	2		
CO 2	2	1	1									1		
CO 3	1	2	2								2	1		
CO 4	2	1	1								1	2		
CO 5	2	2	2									1		

Enter correlation levels 1, 2 & 3 define as: 1-low, 2- medium, & 3-high

11. Text Books & Reference Books

S.N o.	Name of the Book	Author/Publisher/Year/E dition	Web link
1	Object Oriented Programming with C++	E.Balagurusamy, Fifth Edition, Tata McGraw Hill, 2011 (Unit I,II and III)	https://www.edx.org/course/data-structure-s-algorithms-using-c
2	Data Structures and Algorithm Analysis in C++	Mark Allen Weiss, Third edition, Pearson Education Asia, 2010. (Unit IV and V)	https://www.includehelp.com/c-programming-data-structure-examples.aspx
3	Data Structures using C++	D.S.Malik, "Second Edition, 2010.	https://slideplayer.com/slide/13049639/
4	Programming In C++	M.T. Somashekara, PHI Pvt. Ltd., 2008	https://www.slideshare.net/MalarMohana/programming-in-c-ppt
5	Programming with ANSI C++	B.Trivedi, Oxford University Press, 2007	https://slideplayer.com/slide/13438872/
6	Data Structures using C & C++	Rajesh K. Shukla, 2019.	https://www.slideshare.net/NUPOORAW/SARMOL/introduction-to-data-structure-183098263

12. Web Resources:

Sl. No	Topic	Web link
1.	Object oriented paradigm	https://www.tutorialspoint.com/object_oriented_analysis_design/ood_object_oriented_paradigm.htm
2.	List ADT	https://www.geeksforgeeks.org/abstract-data-types/

13. E- learning / NPTEL

Video	https://onlinecourses.nptel.ac.in/noc19_cs40/preview
Lecture Notes	https://drive.google.com/file/d/1wXkh4FL_rfphAv1Ldb7vn6q7oA943ZKm/view

14. MAGAZINE & JOURNALS

Magazine	https://www.academia.edu/29721830/Object_Oriented_Programming_and_Data_Structures
Journals	https://www.wiley.com/enus/Data+Structures+and+Algorithms+with+Object+Oriented+Design+Patterns

15. LESSON PLAN

S. No.	Unit	Topic to be covered	Hours Needed	Mode of Teaching (BB/PPT/Others)	Text/Ref. Book	Page No.
		INTRODUCTION TO OOPS AND C++				
1	I	Object oriented programming paradigm	1	BB	T1	46
2		Basic concepts of object oriented programming - Benefits of OOP	1	BB	T1	52
3		A simple C++ program – Basics of C++	1	BB	T1	157
4		Tokens – Keywords	1	BB	T1	171
5		Identifiers and constants	1	BB	T1	258
6		Basic data types – Declaration of variables	1	BB	T1	268-276
7,8		Operators in C++ - Scope resolution operator	2	BB	T1	278
9		Operator precedence.	1	BB	T1	307
		CONTROL STRUCTURES AND STATEMENTS IN C++				
10	II	Control structures in C++: if statement	1	BB	T1	677
11,12		switch statement – do - else statement - for statement	2	BB	T1	679
13		Functions in C++: Introduction – The main function	1	BB	T1	683
14		Function prototyping	1	BB	T1	685
15		Call by reference - Return by reference	1	BB	T1	690
16		Inline functions - Method overloading	1	BB	T1	690
17		friend and virtual functions	1	BB	T1	695
18		Math library functions	1	Seminar	T1	697
		BASIC OOPS CONCEPTS IN C++				
19	III	Specifying a class – Defining member functions	1	BB	T1	395
20		A C++ program with class parameterized constructors	1	BB	T1	396
21		Multiple constructors in a class	1	BB	T1	398
22		Constructors with default arguments	1	BB	T1	399
23		Copy constructor – Destructors	1	GD	T1	400
24		Operator overloading – Inheritance -single inheritance	1	BB	T1	405

25		Multilevel inheritance – Multiple inheritance	1	PPT	R1	408
26		Hierarchical inheritance	1	PPT	R1	412
27		Hybrid inheritance	1	PPT	R1	416
	IV	BASIC DATA STRUCTURES AND SORTING				
28		Algorithm – analysis	1	BB	T1	48
29		List ADT – Stack ADT	1	BB	T1	56
30		Queue ADT – Priority Queue	1	PPT	T1	74
31		Stack implementation – Basic operations on stack -Application of stack	1	BB	T1	76
32		Queue: Introduction – Definition of Queue	1	BB	T1	77
33		Implementation of Queue – Operation on a Queue – Applications of Queue	1	GD	T1	285
34		Sorting : Bubble sort - Insertion sort	1	PPT	R1	157
35		Merge sort – Quick sort	1	BB	R1	305
36		Searching – hashing	1	BB	R2	326
*		Standard Template Library*	1	PPT		
			GRAPHS AND TREES			
37	V	Trees: Introduction – Tree - Basic elements of a tree	1	BB	T1	574
38		Binary tree – Representation of binary tree	1	PPT	T1	576
39		Operations on binary tree	1	GD	T1	579
40		AVL tree	1	PPT	T1	580
41		Operations on AVL Tree	1	BB	T1	585
42		Graph: Representation	1	BB	R1	589
43		Shortest path algorithm: Dijikstra’s algorithm	1	BB	R1	594
44		Minimum spanning tree	1	BB	R2	597
45		Prim’s Algorithm.	1	BB	R2	603
*		Splay Tree*	1	PPT		
*		Red Block Tree*	1	PPT		
Total Hours Needed: 45(L) + 3* = 48 Hours						

16. CLASS TIME TABLE

Hour/Day	9.00 – 10.00	10.00 – 11.00	11.00 – 11.10	11.10 – 12.10	12.10 – 1.10	1.10 – 2.00	2.00 – 2.50	2.50 – 3.40	3.40 – 3.50	3.50 – 4.40	
MON		DS C++	BR EA K			L U N C H - B R E A K			B R E A K		
TUE											
WED	DS C++ (Test)			DS C++			UHV/ DS C++				
THUR											
FRI		DS C++ LAB		DS C++ LAB						DS C++	

17. COURSE TIME TABLE

Hour/Day	9.00 – 10.00	10.00 – 11.00	11.00 – 11.10	11.10 – 12.10	12.10 – 1.10	1.10 – 2.00	2.00 – 2.50	2.50 – 3.40	3.40 – 3.50	3.50 – 4.40
MON	OS (Test)	DS C++	BR EA K	PE1	COA	L U N C H - B R E A K	NMS	LIB	B R E A K	LIB
TUE	DBMS (Test)	DBA LAB		DBA LAB			PE1(Test)	NMS		IAS/PE1
WED	DS C++ (Test)	NMS		DS C++	DBMS		UHV/ DS C++	UHV/ NMS		DBMS
THUR	NMS (Test)	OS		PE1	COA		DBMS	OS(PC) ^T		OS(PC) ^T
FRI	COA (Test)	DS C++ LAB		DS C++ LAB			COA	DS C++		OS

18. CONTENT DELIVERY METHODOLOGIES

- ☐ Black board
- ☐ PPT
- ☐ GD
- ☐ Seminar

19. ASSIGNMENTS

Assignmen t	PART A	CO	BL
1	Tokens , Keywords , Identifiers and Consonants Basic Data Types	CO1	2
2	Functions in C++	CO2	4
3	Inheritance	CO3	3

4	Queue : Implementation and Operation	CO4	6
5	Dijkstra's & Prim's Algorithm	CO5	1

20. ASSIGNMENT RUBRICS

QUALITY	MARKS
Submission on Date	2
Understanding	3
Solving Skills/Presentation	3
End results with correct units conversions / Conclusion	2

21. MAPPING COs WITH ASSIGNMENTS

CO's	CO - STATEMENTS	A1	A2	A3	A4	A5
CO1	To understand the diff b/w OOPs & POL and Data Types in C++	3	-	-	-	-
CO2	Write C++ programs with features such as composition of objects , polymorphism etc.	-	3	-	-	-
CO3	Write C++ programs with features such as Operator Overloading and Inheritance	-	-	3	-	-
CO4	Choose an appropriate data structure for a particular problem	-	-	-	3	-
CO5	Simulate problems in the subjects like Operating systems , Computer Networks and also real world problems in C++	-	-	-	-	3

22. ASSESSMENT METHODOLOGIES

Assessment Tool		Description
CONTINUOUS ASSESSMENT	40%	CAT – I (8marks), CAT – II (8marks), CAT –III (4marks) will be considered for 20 marks, class test- 5marks, MCQ 10 marks, Assignments-5 marks,
End semester Examination	60%	End semester Examination for 100 marks Converted to 60marks
Course End Survey		At the end of the Course, will be evaluated

23. DISTRIBUTION OF PORTIONS FOR ASSESSMENT TESTS

Assessments		Portion	% of weight age
CONTINUOUS ASSESSMENT	CAT – I	Unit-I & Unit-II	50
	CAT – II	Unit-III& Unit - IV	
	CAT-III	Unit-V	
	Class test(5)	Unit – I to Unit - V	12.5
	Assignments (5)	Unit – I to Unit - V	12.5
	MCQ	Unit – I to Unit - V	25
End Semester		Unit - 1 to 5	100

24. MARK ALLOTMENT FOR CO ASSESSMENT:

COs	CAT – I (Theory)	CAT – II (Theory)	CAT-III (Theory)	Assign ment	Class test	MCQ	End Semester
CO1	25			10	26	6	100
CO2	25			10	26	6	
CO3		25		10	26	6	
CO4		25		10	26	6	
CO5			50	10	26	6	
Marks Converted to	20 (5 * 4)			5	5	10	60

25. LECTURE NOTES**:** **Enclosed****26. CONTENT BEYOND SYLLABUS**

UNIT	TOPICS TO BE COVERED	Hrs Taken
1	Standard Template Library	1
2	Splay Tree	1
3	Red Block Tree	1

27. QUESTION BANK**:** **Enclosed****28. END SEMESTER QUESTIONS PAPERS****:** **Enclosed****29. COURSE REVIEW & CLOSURE REPORT**

No. of hours prescribed for the course	45
No. of hours required or spent for covering additional topics	3
No. of hours required to cover Assignments/tests	5
No. of hours required for tutorials	-
No. of hours required to revise the course content	-
No. of hours required for any other activity related to the course	-
TOTAL HOURS REQUIRED FOR COURSE	53

Signature	Prepared by:	Approved by:	
Name :	Mrs.A.Enitha	Dr.M.Vargheese	Dr.V.Manikandan
Designation:	Asst. Professor	HoD / CSE	Principal
Date:			