RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

ELECTRONICS AND COMMUNICATION ENGINEERING

Semester - II

EC23C06 & DATA STRUCTURES AND PROGRAMMING IN C++

(Regulation2023)

EC 3202

Time: 3hrs Max.Marks: 100

CO1	Comprehend and appreciate the significance and role of this course in the present contemporary world
CO2	Select and realize suitable data structure for specific Application.
CO3	Compare and realize Linear and nonlinear data structures for different application.
CO4	Implement different searching and sorting techniques.
CO5	Identify and realize connected components in trees.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

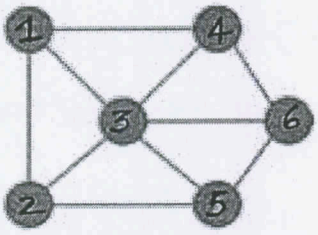
PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	List the member dereferencing operators with their functionality.	2	CO1	1

2	Identify the error in the following program
	#include <iostream.h>
	Class staticFunction
	{
	static int count;
	public:
	static void setCount()
	{
	count++;
	}
	void diplayCount()
	{
	cout << count;
	}
	};
	int staticFunction::count = 10;
	void main()
	{
	staticFunction obj1;
	obj1.setCount(5);
	staticFunction::setCount();
	obj1.displayCount();
	}
		2	CO1	2

3	How do the properties of the following two derived classes differ? (i) class D1:private B{//…}; (ii) class D2:public B{/….};	2	CO2	3
4	What is composition? How does it differ from inheritance?	2	CO2	2
5	A two-dimensional array A[5][10] is implemented in row order manner in the memory. Deduce the address of the A[3][5] element, if the base address of the array is 3000 and the word	2	CO3	3

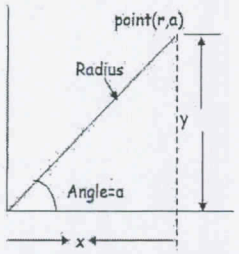
	size is 2. Assume the lower bound of row and column indices to be 1.			
6	Define priority queue. How is it different from a normal queue?	**2**	**CO3**	1
7	Find the degree of all the nodes for the following graph 	**2**	**CO4**	2
8	List out the applications of Tree data structures?	**2**	**CO4**	1
9	Solve the insertion sort for the following elements : 44,33,11,55,77,90,40,60	**2**	**CO5**	2
10	Give the best and worst case time complexity for merge sort and quick sort	**2**	**CO5**	3

PART- B(5x 13=65Marks)

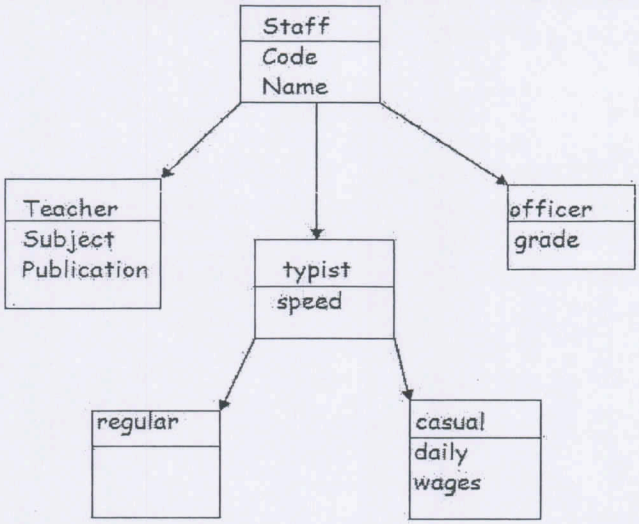
(Restrict to a maximum of 2 subdivisions)

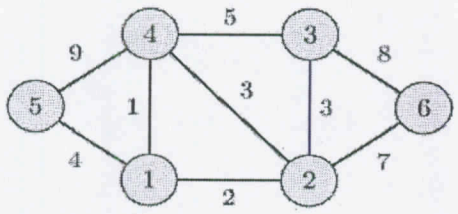
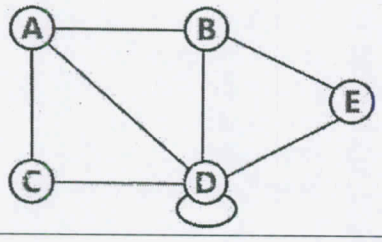
Q.No.	Questions	Marks	CO	BL

11 (a)	Define a class **String** that could work as a user-defined string type. Include constructors that will enable us to create an uninitialized string
	String s1; // string with length 0
	and also to initialize an object with a string constant at the time of creation like
	String s2 ("well done!");
	Include a function that adds two strings to make a third string. Note that the statement s2 = s1;
	Will be perfectly reasonable expression to copy one string to another. Write a complete program to test your class to see that it does the following tasks:
	(i) Creates uninitialized string objects.
	(ii) Creates objects with string constants.
	(iii) Concatenates two strings properly.
	(iv) Display a desired string object.
		13	**CO1**	3

	OR			
11 (b)	Design a class **Polar** which describes a point in the plane using polar coordinates **radius** and **angle**. A point in polar coordinates is shown in fig.1  Fig.1 Polar coordinates of a point Use the overloaded + operator to add two objects (radius and angle) of Polar. Note that we cannot add polar values of two points directly. This requires first the conversion of points into rectangular coordinates, then adding the corresponding rectangular coordinates and finally converting the result back into polar coordinates. You need to use the following trigonometric	13	**CO1**	3

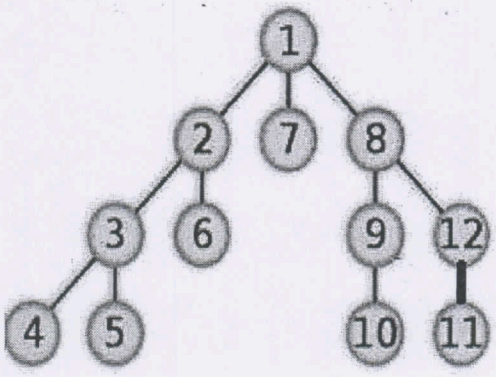
	formulae :
	x = r * cos(a);
	y = r * sin(a);
	a = atan(y/x); // arc tangent
	r = sqrt(x*x + y*y);			

12 (a)(i)	An educational institution wishes to maintain a database of its employees. The database is divided into a number of classes whose hierarchical relationships are shown in fig.2. The figure also shows the minimum information required for each class. Specify all the classes and define functions to create the database and retrieve individual information using C++ program.  Fig.2. Class relationships	10	CO2	4
12 (a)(ii)	Compare and contrast between abstract base classes and concrete classes.	3	CO2	1
	OR			
12 (b)(i)	Create a base class called **shape**. Use this class to store two **double** type values that could be used to compute the area of figures. Derive two specific classes called **triangle** and **rectangle** from the base **shape**. Add to the base class, a member function **get_data()** to initialize base class data members and another member function **display_area()** to compute and display the area of figures. Make **display_area()** as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively, and display the area. Remember the two values given as input will be treated as lengths of two sides in the case of rectangles, and as base and height in the case of triangles, and used as follows: Area of rectangle = x * y Area of triangle = ½ * x * y	10	CO2	4
12 (b)(ii)	Explain with an C++ program the use of '**this**' pointer	3	CO2	1
13 (a)(i)	The contents of a queue Q are as follows: Queue (Q): 4 | 5 | -9 | 66 | | | | | Index: 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 F? R? The queue can store a maximum of eight elements and the front (F) and rear (R) pointers currently point at index 0 and 3 respectively. Show the queue contents and indicate the position of the front	9	CO3	2

	and rear pointers after each of the following queue operations: (i) Insert (Q,16) (ii) Delete (Q) (iii) Delete (Q) (iv) Insert (Q,7) (v) Delete (Q) (vi) Insert (Q,-2) Write a C++ program for the given queue operations with the pictorial representation.			
13 (a)(ii)	Write the algorithm for inserting an element in the beginning and end in a singly linked list	4	CO3	2
	OR			
13 (b)(i)	Convert the following Arithmetic Infix expression (A + (B / C – (D * E ^ F) + G) * H) to Polish notation and Reverse Polish notation using stack implementation of Arrays.	9	CO3	2
13 (b)(ii)	Explain in detail with the algorithm how the given two polynomial equation can be added using linked list $P(x) = 15x^{10} + 3x^5 + 10$ $Q(x) = 10x^8 + 16x^5 + 5x^2$	4	CO3	2
14 (a)(i)	Construct the given set in the level order {A, B, C, D, E, F, G, H, I, J, K, L} and traverse the binary tree in preorder, postorder and inorder traversals. Write down the expressions.	9	CO4	5
14 (a)(ii)	Give an example to demonstrate the union find operation and name any one of its application	4	CO4	2
	OR			
14(b)(i)	Find the Minimal Spanning Tree for a Graph using Prim's algorithm  	9	CO4	5
14(b)(ii)	Represent the following graph using adjacency matrix and adjacency list  	4	CO4	2
15 (a)	Explain the heap sort method with the step by step procedure for sorting the following unordered list of elements (37,26,42,2,8,81,9).Write an algorithm with C++ programming for the given elements.	13	CO5	3
	OR			
15 (b)	Differentiate between linear search and binary search. Write an algorithm and implement a C++ program for performing binary search and linear search for the array {22,13,7,80,89,1,5,110,19} given and write the steps for searching 89 in the above array.	13	CO5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16(i)	Create two classes **DM** and **DB** which store the value of distances. **DM** stores distances in metres and centimetres and **DB** in feet and inches. Write an C++ program that can read values for the class objects and add one object of **DM** with another object of **DB.** Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and centimetres depending on the object on display.	10	**CO1**	3
16(ii)	With a neat step-by-step schematic, solve for Depth First Search algorithm from the following graph 	5	**CO4**	5