Chapter-7

CLASSES AND OBJECTS

➢ Classes:

- ***A class is a collection of objects that have identical properties, common behavior and shared relationship.***
- A class binds the data and its related functions together.

➢ Definition and Declaration of Classes:

- A class definition is a process of naming a class and data variables, and interface operation of the class.
- The variables declared inside a class are known as ***data members.***
- The functions declared inside a class are known as ***member functions.***
- A class declaration specifies the representation of objects of the class and set of operations that can be applied to such objects.
- The general syntax of the class declaration is:


```
class User_Defined_Name
{
        private :
                Data Member;
                Member functions;
        public :
                Data Member;
                Member functions;
        protected :
                Data Member ;
                Member functions;
};
```

- Key word **class** is used to declare a class. User_Defined_Name is the name of the class.
- Class body is enclosed in a pair of flower brackets. Class body contains the declaration of its members (data and functions).
- There are generally three types of members namely private, public and protected.
- Example: Let us declare a class for representation of bank account.

```
class account
{
        private:
```

```
        int accno;
        char name[20];
        char acctype[4];
        int bal_amt;
    public:
        void get_data( );
        void display_data( );
};
```

➢ Access Specifiers:

- Every data member of a class is specified by three levels of access protection for hiding data and function members internal to the class.
- They help in controlling the access of the data members.
- Different access specifiers such as private, public, and protected.

✓ private:

- ***private*** access means a member data can only be accessed by the class member function or friend function.
- The data members or member functions declared ***private*** cannot be accessed from outside the class.
- The objects of the class can access the private members only through the public member functions of the class. This property is also called *information hiding*.
- By default data members in a class are private.
- Example:

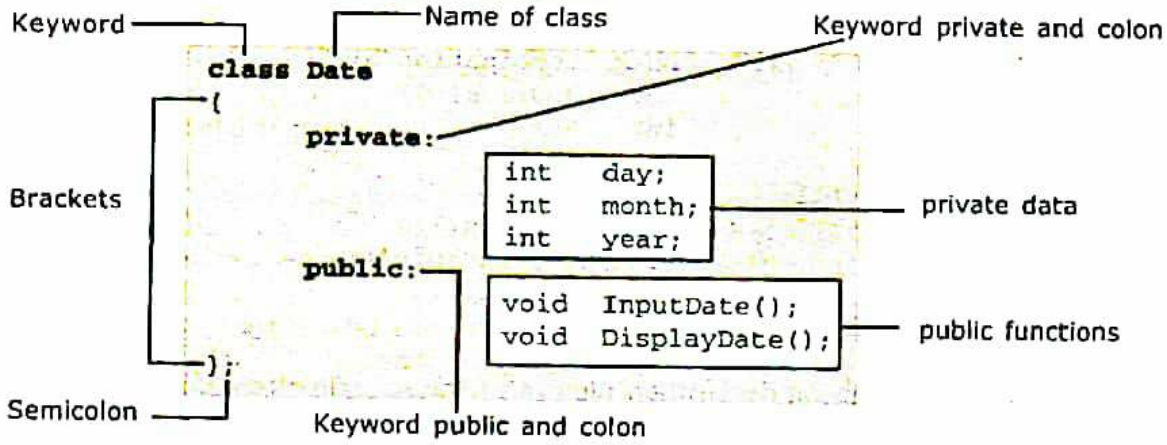
```
private:
    int x;
    float y;
```

✓ protected:

- The members which are declared using ***protected*** can be accessed only by the member functions, friend of the class and also the member functions derived from this class.
- The members cannot be accessed from outside the class.
- The ***protected*** access specifier is similar to private access specifiers.

✓ public:

- ***public*** access means that member can be accessed any function inside or outside the class.
- Some of the ***public*** functions of a class provide interface for accessing the private and protected members of the class.



➢ Member Function:

- Member functions are functions that are included within a class (Member functions are also called Methods).
- Member functions can be defined in two places.
  - Inside class definition
  - Outside class definition

✓ Inside class definition:

- To define member function inside a class the function declaration within the class is replaced by actual function definition inside the class.
- A function defined in a class is treated as inline function.
- Only small functions are defined inside class definition.
- Example:

```
class rectangle
{
        int length, breadth, area;
        public:
                void get_data( )
                {
                        cout<< " Enter the values for Length and Breadth";
                        cin>>length>>breadth;
                }
                void compute( )
                {
                        area = length * breadth;
                }
                void display( )
                {
                        cout<<" The area of rectangle is"<<area;
                }
};
```

✓ Outside class definition:

- To define member function outside the class declaration, you must link the class name of the class with the name of member function.
- We can do this by preceding the function name with the class name followed by two colons (::).
- The two colons (::) are called ***scope resolution operator***.
- Scope resolution operator (::) is used to define the member function outside the class.
- The general form of a member function defined outside the class is:

```
return_type class_name : : member_function_name( arg1, arg2, ....argN)
{
        function body;
}
```

- Example:

```
class operation
{
        private:
                int a, b;
        public:
                int sum( );
                int product( );
};
int operation : : sum( )
{
        return (a+b);
}
int operation : : product( )
{
        return (a * b);
}
```

❖ **Program: To use classes using member functions inside and outside class definition.**

```
#include<iostream.h>
class item
{
        private:
                int numbers;
                float cost;
        public:
                void getdata(int a, float b);
                void putdata( )
                {
                        cout<<"Number: "<<number<<endl;
                        cout<<"Cost:"<<cost<<endl;
                }
};
```

```
void item : : getdata(int a, float b)
{
        number = a;
        cost = b;
}
int main( )
{
        item x;
        x. getdata( 250, 10.5);
        x.putdata( );
        return 0;
}
```

OUTPUT:

Number: 250

Cost: 10.5

➢ Defining object of a class:

- An object is a real world element which is identifiable entity with some characteristics (attributes) and behavior (functions).
- An object is an instance of a class. Objects are sometimes called as instance variables.
- An object is normally defined in the main ( ) function.
- The syntax for defining objects of a class as follows:

```
class Class_Name
{
        private :               //Members
        public :                //Members
};
class   Class_Name   Object_name1, Object_name2,……;
```

where class keyword is optional.

- **Example 1**: The following program segment shows how to declare and create objects.

```
class Student
{
        private:
                int rollno;
                char name[20];
                char gender;
                int age;
        public:
                void get_data( );
                void display( );
};
Student S1, S2, S3;             //creation of objects
```

- Here, creates object S1, S2, and S3 for the class Student.
- When an object is created space is set aside for it in memory.

- **Example 2:**

```
class num
{
        private :
                int x, y;
        public :
                int sum(int p, int q)
                int diff(int p, int q)
};
void main( )
{
        num s1, s2;
        s1.sum ( 200,300);
        s2.diff (600, 500);
}
```

➢ Accessing member of the class:

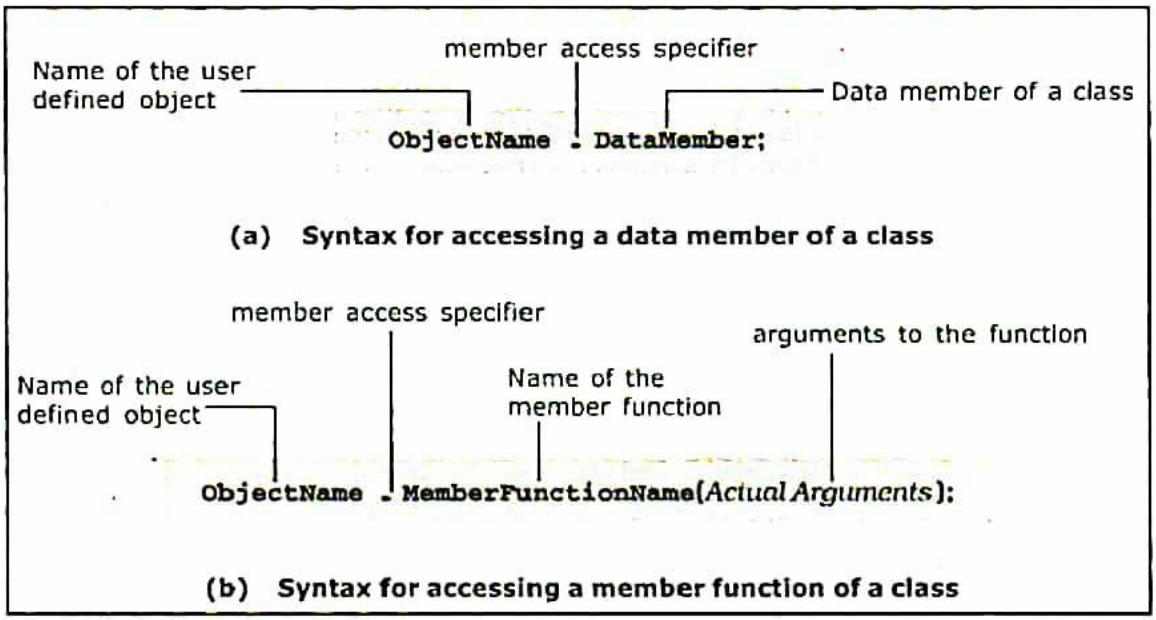
- The member of the class can be data or functions.
- Private and protected members of the class can be accessed only through the member functions of the class.
- No functions outside a class can include statements to access data directly.
- The public data members of objects of a class can be accessed using ***direct member access operator*** (.).
- The syntax of accessing member (data and functions) of a class is:

a) Syntax for accessing a data member of the class:

Object_Name . data_member;

b) Syntax for accessing a member function of the class:

Object_Name . member_function(arguments)



- **Example:**

```
class rectangle
{
        int length, breadth, area;
        public:
                void get_data( )
                {
                        cout<<"Enter the length and breadth"<<end;
                        cin>>length>>breadth;
                }
                void compute( )
                {
                        area = length * breadth;
                }
                void display( )
                {
                        cout<<"The area of rectangle is "<<area;
                }
};
void main( )
{
        rectangle r1;
        clrscr( );
        r1.get_data( );
        r1.compute( );
        r1.display( );
        getch( );
}
```

OUTPUT:

Enter the length and breadth

30 10

The area of rectangle is 300

➢ Array as member of classes:

- Array can be used as a data member of classes.
- An array can be used as private or public member of a class.
- **This is illustrated in the following program.**

```
#include<iostream.h>
#include<conio.h>
class array
{
        private:
                int a[100], m;
        public:
                void setnoofelements( int n);
                {
                        m = n;
                }
```

```
                    void readarray( );
                    void displayarray( );
};
void array : : readarray( )
{
        cout<<"Enter "<<m<<"Array elements"<<endl;
        for(int i=0; i<m; i++)
                cin>> a[i];
}
void array : : displayarray( )
{
        cout<<"Array elements are:"<<endl;
        for(int i=0; i<m i++)
        cout<< a[i]<<"\t";
}
void main( )
{
        int n;
        array a;
        clrscr( );
        cout<<"Input number of elements:"<<endl;
        cin>>n;
        a.setnoofelements(n);
        a.readarray( );
        a.dispalyarray( );
        getch( );
}
```

OUTPUT:

Input number of elements: 5

Enter 5 Array elements

10 20 30 40 50

Array elements are:

10 20 30 40 50

➢ Classes, Objects and Memory:

- The class declaration does not allocate memory to the class data member.
- When a object is declared, memory is reserved for only data members and not for member functions.
- **The following program illustrates as follows:**

```
#include<iostream.h>
#include<conio.h>
class student
{
        private:
                long regno;             //      4 bytes of memory
                char name[20];          //      20 bytes of memory
                char comb[4];           //      4 bytes of memory
                int marks;              //      2 bytes of memory
```

```
        char address[30];          //      30 bytes of memory
    public:
        void readdata( );
        void display( );
};
void main( )
{
    student s1, s2;
    cout<<"Size of the object s1 is = "<<sizeof(s1)<<endl;
    cout<<"Size of the object s2 is = "<<sizeof(s2)<<endl;
    cout<<"Size of the class is = "<<sizeof(student)<<endl;
}
```

OUTPUT:

Size of the object s1 is = 60

Size of the object s2 is = 60

Size of the class is = 60

➢ Array of Objects:

- An array having class type elements is known as array of objects.
- An array of objects is declared after definition and is defined in the same way as any other array.
- Example:


```
class employee
{
    private:
        char name[10];
        int age;
    public:
        void readdata( );
        void displaydata( );
};
employee supervisor[3];
employee sales_executive[5];
employee team_leader[10];
```

- In the above example, the array supervisor contains 3 objects namely supervisor[0], supervisor[1], supervisor[2].
- The storage of data items in an object array is:

	Name	Age
supervisor[0]		
supervisor[1]		
supervisor[2]		

- **Program to show the use of array of objects:**

```
#include<iostream.h>
#include<conio.h>
class data
{
    private:
```

```
                int regno, maths, computer;
        public:
                void readdata( );
                void average( );
                void display( );
};
void data : : readata( )
{
        cout<<"Enter Register No:";
        cin>>regno;
        cout<<"Enter Maths marks:";
        cin>>maths;
        cout<<"Enter Computer marks:";
        cin>>computer;
        dipalay( );
}
void data : : average( );
{
        int avg;
        avg = (maths+computer)/2;
}
void data : : display( )
{
        cout<<"Average = "<<average( )<<endl;
}
void main( )
{
        data stude[3];
        clrscr( );
        for(i=0; i<3; i++)
                stud[i]. readdata( );
        getch( );
}
```

OUTPUT:

```
Enter Register No: 20
Enter Maths marks: 56
Enter Computer marks: 78
Average = 67
Enter Register No: 22
Enter Maths marks: 56
Enter Computer marks: 77
Average = 66
Enter Register No: 10
Enter Maths marks: 44
Enter Computer marks: 89
Average = 66
```

➢ Objects as function arguments:

- A function can receive an object as a function argument.
- This is similar to any other data being sent as function argument.
- An object can be passed to a function in two ways:
    - Copy of entire object is passed to function (Pass by value)
    - Only address of the object is transferred to the function (Pass by reference)
- In **pass by value**, copy of object is passed to the function.
- The function creates its own copy of the object and uses it.
- Therefore changes made to the object inside the function do not affect the original object.

```
#include<iostream.h>
#include<conio.h>
class exam
{
```

```
        private:
                float phy, che, mat ;
        public:
                void readdata( )
                {
                        cout<<"Input Physics, Chemistry, Maths marks : " ;
                        cin>>phy>>che>>mat;
                }
                void total(exam PU , exam CT)
                {
                        phy = PU.phy + CT.phy;
                        che = PU.che + CT.che;
                        mat = PU.mat + CT.mat;
                }
                void display( )
                {
                        cout<< "Physics :" <<phy<<endl;
                        cout<< "Chemistry :" <<che<<endl;
                        cout<< "Maths :" <<mat<<endl;
                }
};
void main( );
{
        Exam PUC, CET, Puc_plus_Cet;
        clrscr( );
        cout<<"Enter PUC Marks"<<endl;
        PUC.readdata( );
        cout<<"Enter CET Marks"<<endl;
        CET.readdata( );
        Puc_plus_Cet.total(PUC, CET);
        cout<<"Total marks of PUC and CET is:" <<endl;
        Puc_plus_Cet.display( );
}
```

OUTPUT:

```
Enter PUC Marks
Input Physics, Chemistry, Maths marks :
67      89      80
Enter CET Marks
Input Physics, Chemistry, Maths marks :
60      76      91
Total marks of PUC and CET is:
Physics: 127
Chemistry: 165
Maths: 171
```

- **In pass by reference**, when an address of an object is passed to the function, the function directly works on the original object used in function call.
- This means changes made to the object inside the function will reflect in the original object, because the function is making changes in the original object itself.
- Pass by reference is more efficient, since it requires only passing the address of the object and not the entire object.

➢ Difference between Structure and Classes:

Structure	Classes
A structure is defined with the struct keyword	A class is defined with the class keyword
All the member of a structure are public by default	All the members of a class are private by default

Structure cannot be inherit	Class can be inherit
A structure contains only data member	A class contain both data member and member functions
There is no data hiding features	Classes having data hiding features by using access specifiers(public, private, protected)

CHAPTER 7 – Classes and Objects BLUE PRINT				
VSA (1 marks)	SA (2 marks)	LA (3 Marks)	Essay (5 Marks)	Total
01 Question	-	-	01 Question	06 Marks
Question No 04	-	-	Question No 31	-

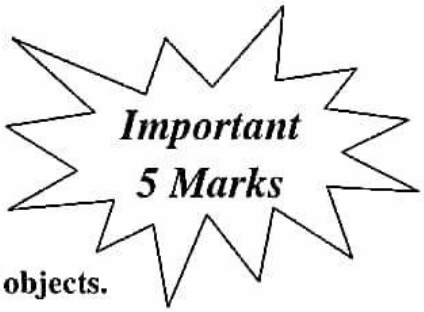
IMPORTANT QUESTIONS:

1 Mark questions:

1. What is a Class, Objects, Data Member, Member Functions, Scope Resolution Operator, and Array of objects?
2. Mention the access specifiers used with a class?

5 Mark questions:

1. Explain class definitions and class declaration with syntax and example.
2. Explain Member function.
   a. Inside class definition
   b. Outside class definition
3. Explain the array of objects.



Exercise programs

1. Write a C++ program to find the simple interest using class and objects.

```
#include<iostream.h>
#include<conio.h>
class SI
{
        private:
                float p, t, r, si;
        public:
                void readdata( )
                {
                        cout<<"Enter the Principal Amount, Time & Rate"<<endl;
```

```
                cin>>p>>t>>r;
        }
        void compute( )
        {
                si = (p * t * r)/100;
        }
        void display( )
        {
                cout<<"Simple Interest = "<<si;
        }
};
void main( )
{
        SI s;
        clrscr( );
        s.readdata( );
        s.compute( );
        s.display( );
        getch( );
}
```

2. **Let product list be a linear array of size N where each element of the array contains following field Itemcode, Price and Quantity. Declare a class Product list with three data members and member functions to perform the following**
   a. **Add values to the product list**
   b. **Printing that total stock values**

```
#include<iostream.h>
#include<conio.h>
#include<iomanip.h>
class product
{
        private:
                char itemcode[6];
                float price, quantity;
        public:
                void Addproduct( )
                {
                        cout<<"Enter the Item Code"<<endl;
                        cin>>itemcode;
                        cout<<"Enter the Price"<<endl;
                        cin>>price;
                        cout<<"Enter the Quantity"<<endl;
                        cin>>quantity;
                }
```

```
                void display( )
                {
                        cout<<itemcode<<"\t"<<price<<"\t"<<quantity<<endl;
                }
};
void main( )
{
        int N=0;
        char ans;
        product list[100];
        clrscr( );
        while(1)
        {
                cout<<"Item Code, Price and Quantity"<<endl;
                List[N].Addproduct( );
                cout<<"Do you want to add next item (Y/N)?"<<endl;
                cin>>ans;
                if(toupper(ans) == 'N')
                break;
                N++;
        }
        cout<<"Item Code \t Price \t Quantity"<<endl;
        for(i=0; i<N; i++)
                List[i].display( );
        getch( );
}
```

3. A class cock has following member hours and minutes. Create member function

a. To initialize the data members

b. Display the time

c. To convert hours and minutes to minutes.

```
#include<iostream.h>
#include<conio.h>
class clock
{
        private:
                int hh, mm;
        public:
                void initialize( int h, int m)
                {
                        hh = h;
                        mm = m;
                }
                void display( )
                {
```

```
                cout<<"Hours = "<<hh;
                cout<<"Minutes = "<<mm;
        }
        void convert( )
        {
                mm = hh * 60 + mm;
                cout<<"Total Minutes = "<<mm;
        }
};
void main( )
{
        int h, m;
        clock c;
        clrscr( );
        cout<<"Enter the Hour and Minutes"<<endl;
        cin>>h>>m;
        c.intialize( );
        c.display( );
        c.convert( )
        getch( );
}
```

4. Write a C++ program that receives arrival time and departure time and speed of an automobile in kilometers/hours as input to a class. Compute the distance travelled in meters/second and display the result using member functions.

```
#include<iostream.h>
#include<conio.h>
class Distance
{
        private:
                int Ahh, Amm, Dhh, Dmm;
                float speed;
        public:
                void inputtime( )
                {
                        cout<<"Enter the Arrival Time:"<<endl;
                        cout<<"Enter the Hour and Minutes"<<endl;
                        cin>>Ahh>>Amm;
                        cout<<"Enter the Departure Time:"<<endl;
                        cout<<"Enter the Hour and Minutes"<<endl;
                        cin>>Dhh>>Dmm;
                        cout<"Enter the speed in Kmph"<<endl;
                        cin>>speed;
                }
                void computedistance( )
```

```
                {
                        float dist;
                        dist = ( (Ahh * 60 + Amm) – (Dhh * 60 + Dmm) ) * speed/60;
                        dist = (dist * 1000 / (60 * 60);
                        cout<<"Distance Travelled = "<<dist<<"Meter/Second";
                }
};
void main( )
{
        Distance d;
        clrscr( );
        d.inputtime( ):
        d.computedistance( );
        getch( );
}
```

****