OBJECT ORIENTED PROGRAMMING
(CSEN 3003)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i)
```
#include<iostream>
using namespace std;
class Base1 {
public:
        Base1( )
        { cout << " Base1's constructor called" << endl; }
};
class Base2 {
public:
        Base2( )
        { cout << "Base2's constructor called" << endl; }
};
class Derived: public Base1, public Base2 {
public:
        Derived( )
        { cout << "Derived's constructor called" << endl; }
};
int main()
{
        Derived d;
        return 0;
}
```
Output of the above code will be:

(a) Base1’s constructor called
Base2’s constructor called
Derived’s constructor called

(b) Base2’s constructor called
Base1’s constructor called
Derived’s constructor called

(c) Derived’s constructor called

(d) Compiler error.

(ii) Object of a class can be passed as an argument to Copy constructor via
(a) pass by value (b) pass by address
(c) pass by reference (d) any of the above.

(iii) Which of the following is true about inline functions and macros?
(a) Macros are processed by pre-processor and inline functions are processed in later stages of compilation
(b) Inline functions do type checking for parameters, macros don't
(c) Macros are prone to bugs and errors, inline functions are not
(d) All of the above.

(iv) Which of the following operators cannot be overloaded?
(a) New (b) Delete (c) Subscript (d) Dot.

(v) A destructor is called
(a) when main() method is loaded (b) when an object goes out of scope
(c) when an object is created (d) all of these.

(vi) Which of the following cannot be used with the virtual keyword?
(a) Class (b) Member function
(c) Constructor (d) Destructor.

(vii) Which of the following exception is thrown when divided by zero statement is executed?
(a) NullPointerException (b) NumberFormatException
(c) ArithmeticException (d) None of these.

(vii) Which of the following is FALSE about abstract classes in Java?
(a) If we derive an abstract class and do not implement all the abstract methods, then the derived class should also be marked as abstract using 'abstract' keyword
(b) Abstract classes can have constructors
(c) A class can be made abstract without any abstract method
(d) A class can inherit from multiple abstract classes.

(viii) What is the output of the following program?

```
class T {
 int t = 20;
T( ) {
   t = 40;
 }
}
class Test {
  public static void main(String args[]) {
    T t1 = new T();
    System.out.println(t1.t);
  }
}
```

(a) 20 (b) Compile error (c) Garbage value (d) 40.

(x) Which of the following is/are true about packages in Java?
(1) Every class is part of some package.
(2) All classes in a file are part of the same package.
(3) If no package is specified, the classes in the file go into a special unnamed package.
(4) If no package is specified, a new package is created with folder name of class and the class is put in this package.
(a) Only 1, 2 and 3 (b) Only 1, 2 and 4 (c) Only 4 (d) Only 1 and 3.

Fill in the blanks with the correct word

(xi) In Java, the _____ keyword is used to list the exceptions that a method can throw.

(xii) The instance of a class is called the _________ of the class.

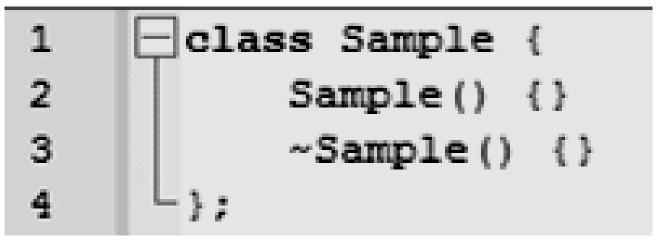
(xiii) Inheritance is a _________ relationship.

(xiv) Template is an example of _________-time polymorphism.

(xv) An abstract class in C++ is one that has at least one ________ virtual function.

Group - B

2. (a) What is the difference between pass by reference and pass by address? Explain with an example. *[(CO3)(Apply/IOCQ)]*
(b) Write a program to declare a void pointer, assign the address of an integer to it and then print the value. *[(CO3)(Understand/LOCQ)]*
(c) The methods in line number 2 and 3 are special functions. What are they called and what should these methods be typically used for? *[(CO2)(Understand/LOCQ)]*



```
1 class Sample {
2      Sample() {}
3      ~Sample() {}
4 };
```

(2 + 2) + 4 + (2 + 2) = 12

3. (a) How do you differ encapsulation from abstraction? *[(CO1)(Understand/LOCQ)]*
(b) What would be the output of the following code? Please explain your answer.

```
#include<iostream>
using namespace std;
class test{
public:
          test(){cout<<"Cons"<<endl;}
        ~test(){cout<<"Dest"<<endl;}
};
int main(){
        for(int i=0;i<2;i++)
                test obj;
        return 0;
}
```

[(CO2)(Compare/LOCQ)]

(c) Suppose you are creating multiple objects of a class. You want to calculate the number of objects alive. How do you do that with the help of a static class variable? *[(CO3)(Understand/IOCQ)]*

4 + (2 + 2) + 4 = 12

Group - C

4. (a) Please add proper function in the following incomplete code snippet such that it runs and give the following output:

```
#include<iostream>
using namespace std;
class test{
 int i;
};
int main(){
test obj;
cout<<"Enter input"<<endl;
cin>>obj;
cout<<obj;
return 0;
}
```

Expected Output:

```
Enter input
5
5
```

[(CO6)(Analysis & Design/LOCQ)]

(b) How to define an abstract class in C++? What is the use of an abstract class? Why cannot you instantiate an abstract class? *[(CO5)(Demonstrate/LOCQ)]*

(c) How to implement multiple inheritance in C++? *[(CO5)(Demonstrate/LOCQ)]*

(2 + 2) + (2 + 2 + 2) + 2 = 12

5. (a)

```
#include <iostream>
using namespace std;
class parent {
   protected: int i=10;
public:void show(){cout<<"In parent "<<endl;}
};
class child1:public parent {
   public:void show() {cout<<"In child 1 "<<endl;}
};
class child2:public parent {
   public:void show() {cout<<"In child 2 "<<endl;}
};
class problemChild: public child1, public child2 {
   public:void show() {cout<<"Value of i is:  "<<i<<endl;}
};
int main() {
   parent *p;
   p=new child1();
   p->show();
   p=new problemChild();
   p->show();
   }
```

Consider the above program and answer the following two questions.

(i) The program implements a typical type of inheritance that gives compilation error when not implemented properly. Identify and explain why the above piece of code will give compilation error. Fix the error.

(ii) The expected output of the program:

```
In child 1
Value of i is: 10
```

After you fix the compilation error, what else do you have to modify in the program to get this output? Explain your answer. *[(CO5)(Understand/HOCQ)]*

(b) Write a class template for adding two inputs. Specialize the template such that for string input, it appends the given string inputs. *[(CO5)(Demonstrate/IOCQ)]*

6 + 6 = 12

Group - D

6. (a) Why should main method be declared as public and static in Java? What is the role of the String args[ ] parameter of the main method? *[(CO2)(Analyse/IOCQ)]*

(b) What is the use of the finalize method in Java? When is the finalize method called? *[(CO3)(Remember/LOCQ)]*

(c)

```
class test
{
  public static void main(String args[])
   {
  final int i = 30;
```

```
    i = 60;
  }
}
```

Can you identify what is wrong in the above piece of code and fix it? *[(CO5)(Apply/LOCQ)]*

4 + 6 + 2 = 12

7. (a) How to experience runtime polymorphism in Java? Write a Java code and explain. *[(CO5)(Demonstrate/IOCQ)]*
   (b) Why Java is called platform independent where C++ is not? *[(CO1)(Understand/LOCQ)]*
   (c) What is inner class in Java? How to instantiate an inner class from main? *[(CO2)(Compare/LOCQ)]*

5 + 4 + 3 = 12

Group - E

8. (a) Is there any way to implement multiple inheritance in Java? Specify if any. *[(CO5)(Demonstrate/IOCQ)]*
   (b) Why applets are secure? Write one difference between applet and application program. *[(CO2)(Compare/LOCQ)]*
   (c) What is the default type of variables in an interface?
   Consider the following Java program:

```
interface MyInterface { int a=10; void display();}
class Test2023 implements MyInterface
{
   public void display() {
      a=20;
      System.out.println("Value of a is " + a);
   }
    public static void main(String args[]) {
       MyInterface ref=new Test2023();
       ref.display();
    }
}
```

Have the variables been declared and used properly in the above program? If you find any discrepancy point it out and suggest a fix. *[(CO5)(Apply/IOCQ)]*

4 + 2 + (4 + 2) = 12

9. (a) Explain what is meant by checked and unchecked exception. Give examples of each category. *[(CO3)(Remember/LOCQ)]*
   (b) What are the two approaches of creating a thread in java? Which approach do you prefer and why? *[(CO4)(Remember/IOCQ)]*
   (c) Explain the Delegation event model and elaborate on the role that each of the main components play. *[(CO6)(Apply/IOCQ)]*

4 + 3 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	51.05	42.7	6.25

Course Outcome (CO):

After the completion of the course students will be able to

CSEN3003.1 Understand the principles and philosophies of object-oriented programming paradigm: encapsulation, abstraction, polymorphism, reuse through inheritance and dynamic binding.

CSEN3003.2 Compare the procedural and object oriented paradigm with concepts of input/output streams, abstraction through classes, polymorphism through overloaded functions, class and objects.

CSEN3003.3 Understand parameter passing techniques, value(C, Java) vs. reference(C++), errors and exceptions, OOP concepts of classes, initialization, cleanup, polymorphism techniques.

CSEN3003.4 Apply multithreading techniques to improve performance.

CSEN3003.5 Demonstrate OOP concepts of member access control, class relationships, inheritance and component, dynamic binding, abstract class, virtual inheritance, generic types and functions

CSEN3003.6 Analysis and Design of Object Oriented Software with ability to model and develop solutions using C++ and Java implementing object-oriented paradigm concepts.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*