OBJECT ORIENTED PROGRAMMING
(CSEN 3103)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   The default access specifier in C++ is
            (a) default   (b) public   (c) private   (d) protected.

    (ii)   If class A is a friend of class B and class C is a child of class B, then class A is class C's
            (a) friend   (b) child   (c) not friend   (d) parent.

    (iii)   ```
            #include<iostream>
            using namespace std;
            class Base
            {
            public:
              virtual void show() = 0;
            };
            int main(void)
            {
              Base b;
              Base *bp;
              return 0;
            }
            ```
            (a)  There are compiler errors in lines, "Base b;" and "Base*bp;"
            (b)  There is a compiler error in line "Base b;"
            (c)  There is a compiler error in line "Base*bp;"
            (d)  There is no compiler error.

    (iv)    The dot operator (or class member access operator) connects the following two
            entities (reading from left to right):
            (a)  A class member and a class object
            (b)  A class object and a member of that class
            (c)  A class object and a class
            (d)  A class and a member of that class.

(v) If 'f' is a virtual function in a class X, then:
    (a) 'f' must return an int
    (b) 'f' must be overridden in all classes inherited from X
    (c) There cannot be any non virtual function named 'f' with identical signature in X
    (d) None of the above.

(vi) What will be the output of the following program?

```
class superClass
{
        final public int calc(int a, int b)
        {
            return 0;
        }
}
class subClass extends superClass
{
        public int calc(int a, int b)
        {
            return 1;
        }
}
public class Test
{
        public static void main(String args[])
        {
            subClass get = new subClass();
            System.out.println("x = " + get.calc(0, 1));
        }
}
```

    (a) x = 1   (b) x = 0   (c) compiler error   (d) none of the above.

(vii) When a button is pressed in an applet, which event is generated?
    (a) Action Event   (b) Button Press Event
    (c) Input Event   (d) Component Event.

(viii) Exceptions are thrown
    (a) from the catch block to the try block
    (b) from a throw statement to the try block
    (c) from the point of the error to a catch block
    (d) from a throw statement to a catch block.

(ix) Which of the following statement is not true?
    (a) Members of the inner class are known only within the scope of the inner class and may not be used by the outer class
    (b) An instance of an inner class can be created only within the scope of outer class
    (c) If you have the static member inside static nested class, you don't need to create instance of static nested class
    (d) An inner class has access to all of the members of its enclosing class, and the reverse is also true i.e. enclosing class also can access all the members of an inner class.

(x)   Which of the following is a correct interface?
(a)
interface A {
void print() { };
}
(b)
abstract interface A {
print();
}
(c)
abstract interface A extends I1, I2 {
abstract void print() { };
}
(d)
interface A {
void print();
}

Group – B

2. (a)   Can a destructor be overloaded? Reason your answer.
Suppose there are two objects t1 and t2 of a class Test.
Write a code in C++ such that we get to know the sequence of object creation and deletion properly. Please note that, there must not be any printing statements within the main function.

(b)   How do you initialize a static variable of a class in C++?
Write two restrictions of a static function.
Explain the output of the following program:

```cpp
#include <iostream>
using namespace std;
class Test
{
        static int x;
public:
        Test() { x++; }
        static int getX() {return x;}
};

int Test::x = 0;

int main()
{
        cout << Test::getX() << " ";
        Test t[5];
        cout << Test::getX();
        return 0;
}
```

(2 + 3) + (2 + 2 + 3) = 12

3. (a) What do you mean by a reference variable? Write proper syntax to declare a reference variable.

   (b) What is a friend function and a friend class? Explain with examples.

   (c) Explain the following objects with examples and also the scopes of the respective objects.
   (i) Constant objects   (ii) Nameless Objects.

   2 + 6 + (2 + 2) = 12

Group – C

4. (a) Illustrate the different uses of the keyword "throw", using code excerpts, w.r.t exception handling in C++. (Please note: Writing relevant lines of code, instead of the whole program, will suffice as long as the correct meaning is conveyed without any ambiguity.)

   (b) What is a class template? Explain with an example, how to define a method outside a class using a class template?

   (c) How can you implement runtime polymorphism in C++, Explain with an example.

   4 + 4 + 4 = 12

5. (a) What will be the output of the following codes? Explain your answer. Please note that there might be compiler or runtime errors.
   (i)
```cpp
#include <iostream>
using namespace std;

int main()
{
  try
  {
    throw 10;
  }
  catch (...)
  {
    cout << "default exceptionn";
  }
  catch (int param)
  {
    cout << "int exceptionn";
  }
  return 0;
}
```
   (ii)
```cpp
#include <iostream>
using namespace std;
```

```cpp
template <typename T>
T maxn(T x, T y)
{
    return (x > y)? x : y;
}
int main()
{
    cout << maxn(3, 7) << std::endl;
    cout << maxn(3.0, 7.0) << std::endl;
    cout << maxn(3, 7.0) << std::endl;
    return 0;
}
```

(b) Write a code in C++ to implement post-increment operator and << operator. Using your code, what will be the output of the following input? Suppose the class name is Test.
Test t(10);
Test t2=t++;
cout<<"t="<<t<<endl<<"t2="<<t2<<endl;

(2 + 2)+ (3 + 3 + 2) = 12

Group – D

6. (a) How do you implement compile-time polymorphism in Java?
Write the output of the following code and explain.

```java
class Test
{
    void myMethod()
    {
        System.out.println("Semester");
    }
}
public class Derived extends Test
{
    void myMethod()
    {
        System.out.println("Even Sem");
    }
    public static void main(String[] args)
    {
        Derived object = new Test();
        object.myMethod();
    }
}
```

(b) Name the functions to take an integer, one word, and one line input from the user using Scanner class.
What will be the output of the following program? Explain.

```java
class Department
{
        Department()
        {
                System.out.println("CSE");
        }
        Department (String name)
        {
                this();
                System.out.println("CSE: String Constructor" + name);
        }
}
public class thirdyear extends Department
{
        thirdyear ()
        {
                System.out.println("Third year ");
        }
        thirdyear (String name)
        {
                this();
                System.out.println("Third year: String Constructor" + name);
        }
        public static void main(String[] args)
        {
                new thirdyear("Section A+B+C");
        }
}
```

(3 + 3) + (3 + 3) = 12

7. (a) Explain method overloading and method overriding in java with examples.

    (b) State the differences between Inner Class and Static Nested class.

    (c) What are the different uses of the keyword super in java? Explain with an example.

    6 + 3 + 3 = 12

Group – E

8. (a) Define the terms abstract classes and interfaces. What are the similarities and differences between abstract classes and interfaces?

    (b) What are the similarities and differences between synchronized method and synchronized block in java thread, explain with examples.

    6 + 6 = 12

9. (a) Write the uses of finally block in Java.

Write and explain the output of the following program.

```java
public class Test
{
    public static void main(String[] args)
    {
        try
        {
            System.out.printf("1");
            int data = 5 / 0;
        }
        catch(ArithmeticException e)
        {
            System.out.printf("2");
            System.exit(0);
        }
        finally
        {
            System.out.printf("3");
        }
        System.out.printf("4");
    }
}
```

(b)   Explain how an event delegation model works. Write a Java program to pass a parameter to an applet.

(3 + 3) + (3 + 3) = 12

Department & Section	Submission link:
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