Experiment Number : 06 **Date: 04-02-26**

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CSE-A1

ABSTRACT CLASSES

Aim:

To understand and implement inheritance concepts in Java.

PRE LAB EXERCISE

QUESTIONS

1. **What is an abstract class?**

   An **abstract class** is a class that **cannot be instantiated (no objects)** and is meant to be **inherited**.

   It can contain:

   - **Abstract methods** (methods without body)
   - **Concrete methods** (methods with body)
   - **Variables and constructors**

   It acts as a **base/blueprint** for other classes.

2. **Why are abstract methods used?**

   Abstract methods are used to:

   - **Force subclasses to implement specific methods**
   - Ensure **common structure/behavior** across related classes
   - Support **partial abstraction** (some logic in base class, some left to child)

3. **Difference between abstract class and interface.**

Abstract Class	Interface
Can have **abstract + concrete methods**	Only **abstract methods** (Java 7)
Can have **instance variables**	Only **public static final constants**
Supports **constructors**	❌ No constructors
A class can extend **only one** abstract class	A class can implement **multiple interfaces**
Uses `extends` keyword	Uses `implements` keyword
Supports **partial abstraction**	Supports **100% abstraction**

IN LAB EXERCISE

Objective:

To implement abstract class and demonstrate abstraction.

PROGRAMS:

1.University System

Scenario:

A university has different types of courses: Online, Offline, and Hybrid. Each course has a getDetails() method.

Question:

Create an abstract class Course with abstract method getDetails(). Implement OnlineCourse, OfflineCourse, and HybridCourse classes.

Code:

```
abstract class Course {
   abstract void getDetails();
}

class OnlineCourse extends Course {
```

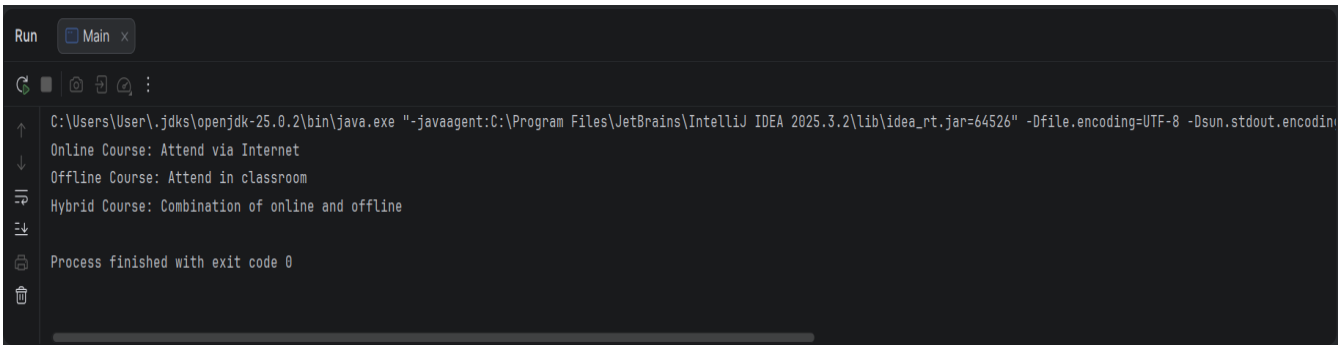
```
    void getDetails() {
        System.out.println("Online Course: Attend via Internet");
    }
}

class OfflineCourse extends Course {
    void getDetails() {
        System.out.println("Offline Course: Attend in classroom");
    }
}

class HybridCourse extends Course {
    void getDetails() {
        System.out.println("Hybrid Course: Combination of online and offline");
    }
}

public class Main {
    public static void main(String[] args) {
        Course c1 = new OnlineCourse();
        Course c2 = new OfflineCourse();
        Course c3 = new HybridCourse();

        c1.getDetails();
        c2.getDetails();
        c3.getDetails();
    }
}
```

Output:

Online Course: Attend via Internet

Offline Course: Attend in classroom

Hybrid Course: Combination of online and offline



2. Employee Payroll System

Scenario:

A company has different types of employees — Regular and Contract. All employees have a salary, but the calculation differs for each type.

Question:

Design an abstract class Employee with an abstract method calculateSalary(). Implement subclasses RegularEmployee and ContractEmployee to calculate salary differently.

Code:

```
import java.util.Scanner;

abstract class Employee {
    String name;
    double baseSalary;

    // Abstract method to calculate total salary
    abstract void calculateSalary();
}
```

```
class RegularEmployee extends Employee {
    double bonusRate = 0.1; // 10% bonus

    void calculateSalary() {
        double totalSalary = baseSalary + (baseSalary * bonusRate);
        System.out.println("Regular Employee: " + name);
        System.out.println("Base Salary: " + baseSalary);
        System.out.println("Total Salary (with 10% bonus): " + totalSalary);
    }
}

class ContractEmployee extends Employee {
    void calculateSalary() {
        System.out.println("Contract Employee: " + name);
        System.out.println("Total Salary: " + baseSalary);
    }
}

public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        // Input for Regular Employee
        System.out.print("Enter Regular Employee Name: ");
        String regName = sc.nextLine();
        System.out.print("Enter Base Salary: ");
        double regSalary = sc.nextDouble();
```

```
        sc.nextLine(); // Consume newline

        // Input for Contract Employee
        System.out.print("Enter Contract Employee Name: ");
        String conName = sc.nextLine();
        System.out.print("Enter Base Salary: ");
        double conSalary = sc.nextDouble();

        // Create objects
        Employee e1 = new RegularEmployee();
        e1.name = regName;
        e1.baseSalary = regSalary;

        Employee e2 = new ContractEmployee();
        e2.name = conName;
        e2.baseSalary = conSalary;

        System.out.println("\n--- Salary Details ---");
        e1.calculateSalary();
        System.out.println();
        e2.calculateSalary();

        sc.close();
    }
}
```

Output:

```
Enter Regular Employee Name: Ram
Enter Base Salary: 30000
```

Enter Contract Employee Name: Ravi

Enter Base Salary: 20000

--- Salary Details ---

Regular Employee: Anitha

Base Salary: 30000.0

Total Salary (with 10% bonus): 33000.0

Contract Employee: Ravi

Total Salary: 20000.0

3.Banking System

Scenario:

A bank has different types of accounts: Savings and Current. Both accounts need a method to calculate interest, but the calculation differs for each account type.

Question:

Use an abstract class BankAccount with an abstract method calculateInterest() and implement it in SavingsAccount and CurrentAccount classes.

Code:

```
abstract class BankAccount {
    String accountHolder;
    double balance;
```

```
    BankAccount(String name, double bal) {
        accountHolder = name;
        balance = bal;
    }

    abstract void calculateInterest();  // Abstract method
}

class SavingsAccount extends BankAccount {
    double interestRate = 0.04; // 4% interest

    SavingsAccount(String name, double bal) {
        super(name, bal);
    }

    void calculateInterest() {
        double interest = balance * interestRate;
        System.out.println("Savings Account Interest for " + accountHolder + " = " +
interest);
    }
}

class CurrentAccount extends BankAccount {
    double interestRate = 0.02; // 2% interest

    CurrentAccount(String name, double bal) {
        super(name, bal);
    }
```

```
    void calculateInterest() {
        double interest = balance * interestRate;
        System.out.println("Current Account Interest for " + accountHolder + " = " +
interest);
    }
}

public class Main {
    public static void main(String[] args) {
        BankAccount acc1 = new SavingsAccount("Ram", 50000);
        BankAccount acc2 = new CurrentAccount("Ravi", 80000);

        acc1.calculateInterest();
        acc2.calculateInterest();
    }
}
```

Output

Savings Account Interest for Ram = 2000.0

Current Account Interest for Ravi = 1600.0

POST LAB EXERCISE

1. How is an abstract class different from a regular class?

   An abstract class can have abstract methods (without body) and cannot be instantiated, whereas a regular class has only concrete methods and can be instantiated.

2. Can you create an object of an abstract class? Why or why not?

   No.

   An abstract class is **incomplete**, so Java does not allow creating its object.

3. What happens if a subclass does not implement an abstract method?

   The subclass **must be declared abstract**, otherwise a **compile-time error** occurs.

4. Can an abstract class exist without any abstract methods?

   Yes.

   An abstract class can exist without abstract methods to **prevent object creation**.

5. Can an abstract class extend another abstract class?

   Yes.

   An abstract class can extend another abstract class and may implement its abstract methods or leave them for subclasses.

Result:

Thus the abstract classes and methods were implemented and executed successfully.

ASSESSMENT

Description	Max Marks	Marks Awarded
Pre Lab Exercise	**5**	
In Lab Exercise	**10**	
Post Lab Exercise	**5**	
Viva	**10**	
Total	**30**	
	Faculty Signature	