

**ABSTRACT CLASSES:****Aim:**

To understand and implement inheritance concepts in Java.

**PRE LAB EXERCISE:****QUESTIONS****✓ What is an abstract class?**

An abstract class is a class that cannot be instantiated and is used as a base class. It may contain both abstract methods (without body) and concrete methods (with body).

**✓ Why are abstract methods used?**

Abstract methods are used to define methods without implementation. They force subclasses to provide their own implementation, ensuring proper design and flexibility.

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

<b>Abstract Class</b>	<b>Interface</b>
Can have abstract and non-abstract methods	Contains only abstract methods (Java 7) / default methods (Java 8+)
Can have variables and constructors	Cannot have constructors
Supports inheritance using extends	Implemented using implements
Supports single inheritance	Supports multiple inheritance
Methods can have access modifiers	Methods are public by default

## 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: Sanjanaa
Enter Base Salary: 100000
Enter Contract Employee Name: Yashna
Enter Base Salary: 50000

--- Salary Details ---
Regular Employee: Sanjanaa
Base Salary: 100000.0
Total Salary (with 10% bonus): 110000.0

Contract Employee: Yashna
Total Salary: 50000.0
```

### 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:

- ✓ **How is an abstract class different from a regular class?**

An abstract class cannot be instantiated and may contain abstract methods, while a regular class can be instantiated and contains only implemented methods.

- ✓ **Can you create an object of an abstract class? Why or why not?**

No, we cannot create an object of an abstract class because it is incomplete and meant to be used as a base class for subclasses.



✓ **What happens if a subclass does not implement an abstract method?**

If a subclass does not implement an abstract method, it must also be declared as an abstract class.

✓ **Can an abstract class exist without any abstract methods?**

Yes, an abstract class can exist without abstract methods. It is used to prevent object creation and to provide a base class.

✓ **Can an abstract class extend another abstract class?**

Yes, an abstract class can extend another abstract class. The subclass may implement the abstract methods of the parent class or remain abstract.

**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	
<b>Total</b>	<b>30</b>	
<b>Faculty Signature</b>		