Experiment Number : 06 **Date: 4.2.2026**

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 is declared using the `abstract` keyword.
  - It **cannot be instantiated** (object cannot be created).
  - It may contain **abstract methods and non-abstract methods**.
  - It is used as a **base class** for other classes.
  - Subclasses must implement the abstract methods of the abstract class.

- ✓ Why are abstract methods used?
  - Abstract methods are methods **without a body**.
  - They are used to **force child classes** to provide implementation.
  - They ensure a **common method structure** across subclasses.
  - They help achieve **abstraction** by hiding implementation details.
  - They improve **code consistency and design**.

- ✓ Difference between abstract class and interface.

Abstract Class	Interface
Can have abstract and non-abstract methods	Contains only abstract methods (Java < 8)
Supports constructors	Does not support constructors
Supports instance variables	Supports only public static final variables
Uses extends keyword	Uses implements keyword
Supports partial abstraction	Supports full 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");
    }
}
```

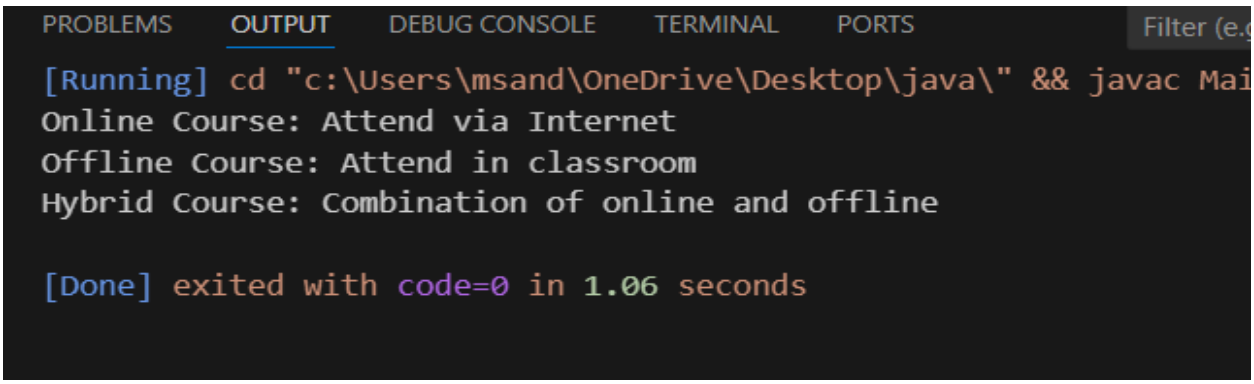
```
class HybridCourse extends Course {
    void getDetails() {
        System.out.println("Hybrid Course: Combination of online and offline");
    }
}

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
```

```
PS C:\Users\msand\OneDrive\Desktop\java> java Main
Enter Regular Employee Name: Ram
Enter Base Salary: 30000
Enter Contract Employee Name: Ravi
Enter Base Salary: 20000

--- Salary Details ---
Regular Employee: Ram
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

```
PS C:\Users\msand\OneDrive\Desktop\java> javac Main.java
PS C:\Users\msand\OneDrive\Desktop\java> java Main
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 is declared using the `abstract` keyword.
- A regular class is declared without the `abstract` keyword.
- An abstract class **may contain abstract methods**, while a regular class cannot.
- An abstract class **cannot be instantiated**, but a regular class can.
- Abstract classes are used to provide a base structure for subclasses.

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

 No, an object of an abstract class **cannot be created**.

 This is because abstract classes may contain **incomplete (abstract) methods**.

- Creating an object without full implementation is not allowed.
- Abstract classes are meant to be **inherited**, not instantiated.

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

- If a subclass does not implement all abstract methods:
  - The subclass must be declared as **abstract**.
- Otherwise, the program will give a **compile-time error**.
- This rule ensures that abstract methods are properly implemented.

✓ Can an abstract class exist without any abstract methods?

- Yes, an abstract class **can exist without abstract methods**.
- It is declared abstract to **prevent object creation**.
- Such classes are used to provide a **common base class**.
- It can still contain variables and concrete methods.

✓ Can an abstract class extend another abstract class?

- Yes, an abstract class **can extend another abstract class**.
- It may implement some or none of the abstract methods.
- The remaining abstract methods must be implemented by the final subclass.
- This helps in building **multi-level abstraction**.

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	