The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	:	Bachelor of Software Engineering Honours
Name of the Examination	:	Final Examination
Course Code and Title	:	**EEI3262 Introduction to Object Oriented Programming**
Academic Year	:	2024/25
Date	:	19th February 2026
Time	:	1330-1630h
Duration	:	03 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Four (4)** questions in **Seven (7)** pages.
3. Answer **all** questions.
4. Answer for each question should commence from a new page.
5. This is a Closed Book Test (CBT).
6. Do not use red colour pen or pencil.

Question 01 [40 Marks]

You are designing a Smart Transportation System (STS) for a modern city using the Java programming language. The system manages different types of vehicles that operate within the city. All vehicles share common characteristics such as vehicleID, registrationNumber, and currentLocation (GPS coordinates). However, different vehicle types have unique properties and behaviors:

- **Electric Buses** have additional properties: route number, passenger capacity, and battery level (percentage).
- **Taxis** have additional properties: driver name, fare rate per kilometre, and availability status (Available/Busy).
- **Delivery Trucks** have additional properties: cargo weight limit, current cargo weight, and company name.

The system requires specific functionalities:

- Electric Buses should be able to calculate the estimated range based on battery level (assume 1% battery = 5 km).

- Taxis should be able to calculate fare based on distance travelled.
- Delivery Trucks should be able to check if they can accept additional cargo based on weight limits.

All vehicles must be able to display their status and update their location. As a Software Developer of the STS project, answer the questions given below.

a. Briefly define the following terms in Object Oriented Programming. (08 marks)

i) Method overriding

ii) Static methods

iii) 'this' keyword

iv) An Object

b. Based on the STS project description above, provide the following: (12 marks)

i) Identify suitable parent classes and child classes.

ii) List all the instance variables of "Electric Bus" class that are not inherited from the super class.

iii) Identify two methods that should be created in the parent class.

c. You have created the following Java code for one of the classes in the STS project: (20 marks)

```
public class Vehicle {
  String vehicleID;
  String registrationNumber;
  String currentLocation;
  public Vehicle() {
    vehicleID = "Unknown";
    registrationNumber = "Unknown";
    currentLocation = "0.0,0.0";
  }
  public void displayStatus() {
      System.out.println("Vehicle ID: " + vehicleID);
      System.out.println("Registration: " + registrationNumber);
      System.out.println("Current Location: " + currentLocation);
  }
}
```

i) Identify two issues that are either violated or poorly implemented in this code: one concerning OOP principles related to attributes and the other regarding constructor implementation. For each issue identified, state what is wrong and how it should be corrected.

Hint : During the code review, a senior developer provided the following comments for improvement regarding the code above: "Attributes should not be declared with default access levels, and all vehicles should be created with actual data."

ii) Write the complete, improved Java code for the "ElectricBus" subclass that addresses the issues identified above. Your code must also include:

- Getter and setter methods for batteryLevel with validation (battery level must be between 0 and 100).
- A method named calculateRange() that returns the estimated range in kilometers.
- An overridden displayStatus() method that shows all bus-specific information.

Question 02 [20 Marks]

a. Define two (02) differences between an "instance method" and a "static method" in Object-Oriented Programming? (04 marks)

b. Read the following scenario and identify <u>three</u> objects and their most general classes mentioned. (06 marks)

"Sarah owns a red Toyota Prius hybrid car with registration number ABC-1234. She takes her car to City Auto Workshop every six months for maintenance. Last week, she took her German Shepherd dog named Bruno to the Sunset Veterinary Clinic for a checkup. The veterinarian's name is Michael. He examined Bruno."

c. Below is a sample Java code that includes dynamic polymorphism in Object Oriented Programming. (10 marks)

```
class Animal {
  public void makeSound() {
    System.out.println("Some generic animal sound");
  }
}
```

```
class Cat extends Animal {
   public void makeSound() {
      System.out.println("Meow");
   }
}
class Dog extends Animal {
   public void sound () {
      System.out.println("Baw");
   }
}
public class World{
   public static void main(String[] args){
      Cat c = new Cat();
      c.makeSound();
      Dog d = new Dog();
      d.makeSound();
      Animal a = new Animal();
      a.makeSound();
   }
}
```

What would happen when the below statements are run?. Choose one from the options in the brackets for each statement. (print "Some generic animal sound", print "Meow", print "Baw", An error)

i) c.makeSound();

ii) d.makeSound();

iii) a.makeSound();

Question 03 [20 Marks]

a. Define the following terms in Object-Oriented Programming. (04 marks)

i) Abstraction

ii) Code Refactoring

b. The below code has been written for a university system. Employees and Students have been identified as concrete entities from the business requirement. Refactor and rewrite the below Java code using "Extract super class" technique. (08 marks)

```
public class Employee{
  String name;
  String jobTitle;
}
public class Student{
  String name;
  String programme;
}
```

c. The following Java code that demonstrates the *abstraction* OOP principle, is incomplete. Fill in the blanks with the correct keywords and identifiers. *(Write only the answers needed for the blanks in your answer script. **Do not** write on this paper.)* (08 marks)

```
public (i)..... Car{
  public void turnOnCar();
  public void turnOffCar();
  public String getCarType();
}
public (ii)..... ManualCar implements Car {
  private (iii)..... carType = "Manual";
  public void turnOnCar() {
    System.out.println("turn on the manual car");
  }
  public void turnOffCar() {
    System.out.println("turn off the manual car");
```

```
    }
    public String (iv)..... () {
        return this.carType;
    }
}
```

Question 04 [20 Marks]

a. List down three (03) types of Programming Errors. (03 marks)

b. What is the purpose of the 'try-catch' block in Exception Handling? (04 marks)

c. A weather application converts temperature from Fahrenheit to Celsius using the formula: (05 marks)

$C = (F - 32) \times 5/9$

For example: 32°F should convert to 0°C, 68°F should convert to 20°C and 212°F should convert to 100°C.

The following Java code was written to convert 68°F to Celsius, but it's giving the wrong result. Identify the line that results in this *logical error* and rewrite the corrected code to produce the expected output.

```
public class TemperatureConverter {
    public static void main(String[] args) {
        float fahrenheit = 68.0f;
        double celsius;
        celsius = fahrenheit - 32 * 5 / 9;
        System.out.println(fahrenheit + "°F = " + celsius + "°C");
    }
}
```

d. A student wrote this program to print numbers from 1 to 5, but it has syntax errors. Rewrite the corrected program in your answer script. (08 marks)

```
class NumberPrinter {
    public static void main(String[] args) {
        String keyword = hello" ;
```

```
    for (int i = 1;  i <= 5  i++) {
      System.out.println("Number: " + i);;

    if (3 == 3) {
      System.out.println("Halfway there!")
    }
  }
}
```

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