

Khulna University, Khulna
Electronics and Communication Engineering Discipline

First Year Second Term Examination, Session: 2024-2025

Course No.: 0714 09 CSE 1251

Full Title of the Course: Object Oriented Programming

Credit Hours: 3.00

Full Marks: 60

Time: 03 Hours

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

- | | |
|--|----|
| 1(a) Explain the SOLID principles in Object-Oriented Design with examples. [L-2; CLO-1] | 03 |
| 1(b) What do you mean by encapsulation, inheritance, and polymorphism? [L-2; CLO-1] | 02 |
| 1(c) Create a class Circle with attributes radius. Write default and parameterized constructors and implement method area(). Overload method circumference() (with and without parameters). [L-3; CLO-3] | 05 |
| | |
| 2(a) What is polymorphism? Explain its types. [L-2; CLO-1] | 02 |
| 2(b) Suppose you are designing a Library Management System using Object-Oriented Programming. Write a Java program that: | 08 |
| <div style="margin-left: 40px;"> i) Creates a base class Book with attributes title, author, and price. Include a constructor and a method displayDetails().
 ii) Creates a derived class EBook that inherits from Book and adds an attribute fileSize. Override the method displayDetails() to include file size.
 iii) Override a method calculatePrice() in EBook to apply a 10% discount on the original price. </div> | |
| Write a main() method to create objects of both classes and demonstrate the functionality. [L-3; CLO-3] | |
| | |
| 3(a) What is the role of the final keyword in Java? [L-1; CLO-1] | 02 |
| 3(b) What is constructor overloading? Explain with example. [L-2; CLO-1] | 03 |
| 3(c) Explain use of this() and super() using examples. [L-2; CLO-1] | 03 |
| 3(d) What is the output of the following code? [L-3; CLO-5] | 02 |

```

public class Test {
    public static void main(String[] args) {
        int a = 5;
        int b = a++ + ++a + a;
        System.out.println(b);
    }
}
```


Khulna University, Khulna
Electronics and Communication Engineering Discipline
First Year Second Term Examination, Session: 2024-2025
Course No.: CSE 1251 (R)

Full Title of the Course: **Object Oriented Programming**
 Credit Hours: **3.00** Full Marks: **60** Time: **03 Hours**

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

- | | |
|--|----|
| 1(a) What are the primary concept that support object-oriented programming? | 03 |
| 1(b) What is constructor? Can a class have multiple constructor? Give example. | 03 |
| 1(c) Create a class Circle with attributes radius. Write default and parameterized constructors and implement method area(). Overload method circumference() (with and without parameters). | 04 |
| 2(a) Explain the differences between class and object in OOP. | 02 |
| 2(b) What is polymorphism? Explain its types. | 03 |
| 2(c) Write a Java program to create a class Student with attributes id, name, and cgpa. Include methods to set and display student details. | 05 |
| 3(a) What is the purpose of making a variable static? Explain with a proper example. | 02 |
| 3(b) Write three differences between abstract class and interface. | 03 |
| 3(c) Write a Java program: Create an abstract class Appliance with: Method turnOn()
Create an interface SmartDevice with: Method connectToWifi()
Create a class SmartTV that:
Extends Appliance
Implements SmartDevice
Implement all methods
Demonstrate the senario using main(). | 05 |
| 4(a) Write a program to demonstrate the use of final keyword. | 02 |
| 4(b) What are packages in Java? Why are they used? | 03 |
| 4(c) Create a superclass Shape with a method area (). Create two subclasses: Circle and Rectangle each overriding the area () method.
In the main method, show the area of circle and rectangle. | 05 |

SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5(a) What is an exception? How is it handled in Java? 03
- 5(b) Distinguish between checked and unchecked exceptions. 03
- 5(c) What will be the output of this code segment and explain the output? 04
- ```
public class Test {
 public static void main(String[] args) {
 try {
 int x = 10;
 int y = x / 2;
 System.out.println("Result: " + y);

 int arr[] = new int[3];
 arr[5] = 100;

 System.out.println("End of try");
 }
 catch (ArithmeticException e) {
 System.out.println("Arithmetic Exception");
 }
 catch (ArrayIndexOutOfBoundsException e) {
 System.out.println("Array Exception");
 }
 finally {
 System.out.println("Finally block");
 }

 System.out.println("Program ends");
 }
}
```
- 6(a) Describe two ways of creating a thread in Java. Give examples using Thread class and Runnable interface. 04
- 6(b) Write a Java program where: 06
- Thread 1 calculates and prints the sum of first 10 natural numbers
- Thread 2 calculates and prints the factorial of 5
- Ensure both threads run concurrently and display their outputs.
- 7(a) Write a Java program to take student information from the keyboard and save it into a file named student.txt. 04
- 7(b) Explain the purpose of IOException and FileNotFoundException in Java file handling. 03
- 7(c) What is awt? List some basic awt components. 03
- 8(a) Distinguish between abstraction and encapsulation. 04
- 8(b) What is the output of the following code? 02
- ```
String str = "Programming";
System.out.println(str.substring(3, 6));
System.out.println(str.charAt(5));
```
- 8(c) What are access modifiers in Java? Explain their scopes. 04

Khulna University, Khulna**Electronics and Communication Engineering Discipline****First Year, Second Term Examination****Session: 2024-2025**Course No.: **0531 09 Chem 1175**Full Title of Course: **Chemistry**Full Marks: **60**Time: **03 Hours**Credit Hours: **3.0**

- * The figures in the margin indicate full marks. The questions are of equal value.
- * Use separate sheet for each section.

Section AThere are **Four** questions in this section. Answer any **Three** questions.

- | | |
|--|----------------|
| 1(a) Describe the experiment that led Rutherford to conclude that an atom contains a small, dense, positively charged nucleus at its center. [L2, CLO 2] | 04 |
| 1(b) State 'Pauli's exclusion principle and Azimuthal quantum number with an example. [L1, CLO 1] | 03 |
| 1(c) What is meant by the electronegativity of an element, and how does it vary with atomic volume? [L1, CLO 2] | 03 |
| 2(a) Define the ionization potential of an element with an example, and explain how it changes with atomic volume. [L2, CLO 2] | 03 |
| 2(b) Explain the following terms: (i) Co-ordinate bond; and (ii) Metallic bond. [L2, CLO2] | 03 |
| 2(c) What type of bond is expected to form between a very small cation and a large anion, and why? [L2, CLO 3] | 04 |
| 3(a) Explain the preparation of N-type and P-type semiconductors, including the dopants used and their effects on the electrical properties of the semiconductors. [L2, CLO 3] | 05 |
| 3(b) Write note on "Crossed Aldol Condensation" and "Rimer Timan" reactions? [L1, CLO 1] | 05 |
| 4(a) Explain the following terms: (i) Mole fraction, (ii) Molality, and (iii) Normality." [L4, CLO 2] | 1.5×3
= 4.5 |
| 4(b) How to prepare of 200 ml of a 0.540 M NaOH solution? [L1, CLO 2] | 03 |
| 4(c) Determine the molarity and molality of a 13% (w/w) sulfuric acid (H ₂ SO ₄) solution, given that its density is 1.09 g/mL. [L5, CLO 2] | 2.5 |

Section B

There are **Four** questions in this section. Answer any **Three** questions.

- 5(a) Identify and define the following: 2+3
= 05
- (i) Oxidation half-reaction and Reduction half-reaction.
- (ii) Standard Hydrogen Electrode (SHE) - state its assigned EMF value and why it is chosen as reference. [L2, CLO 2]
- 5(b) Given: $\text{Ag}/\text{Ag}^+(0.01\text{M}) = -0.80\text{ V}$, $\text{Mg}/\text{Mg}^{2+}(0.1\text{M}) = +2.37\text{ V}$. 3+2
= 05
- (i) Analyze whether the reaction is feasible support with EMF calculation.
- (ii) Distinguish between the oxidizing ability of Ag^+ and Mg^{2+} based on their standard reduction potentials. [L4, CLO 4]
- 6(a) Explain the mechanism of electrolysis with the example of hydrochloric acid (HCl). 04
Identify the reactions at the anode and cathode. [L2, CLO 1]
- 6(b) A current of 2.0 amperes is passed through a copper sulphate solution for 1 hour. 3+3
= 06
- (i) Calculate the quantity of electricity passed.
- (ii) Calculate the mass of copper deposited at the cathode. [Electrochemical equivalent of Cu = 0.0003296 g/coulomb]. [L3, CLO 3]
- 7(a) Define (i) Exothermic reaction, (ii) Endothermic reaction with two examples of each. 1.5 × 2
= 03
[L1, CLO 1]
- 7(b) State Hess's Law of Constant Heat Summation. With the help of a suitable example, demonstrate how this law is used to find the heat of formation of a substance when direct experimental measurement is not possible. [L1, CLO 1] 03
- 7(c) The following thermochemical equations are given: (i) $\text{C(s)} + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}); \Delta H = -394\text{ kJ/mol}$ (ii) $\text{CO(g)} + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}); \Delta H = -283\text{ kJ/mol}$. 04
Calculate the standard enthalpy of formation of carbon monoxide (CO) for the reaction:
 $\text{C(s)} + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CO(g)}; \Delta H = ?$ [L3, CLO 2]
- 8(a) Define pH. Calculate the pH and pOH of: 1+3
= 04
- (i) 0.005 M H_2SO_4 solution (ii) 0.02 M KOH solution. [L3, CLO 1]
- 8(b) Derive the rate equation for a first-order reaction and illustrate it with a suitable example. The expression for a first-order reaction is: $k = \frac{2.303}{t} \times \log \frac{a}{a-x}$. [L3, CLO 1] 04
- 8(c) Differentiate in between molecularity and order of a chemical reaction. [L4, CLO 2] 02

Khulna University, Khulna
Electronics and Communication Engineering Discipline
First Year, Second Term Examination
Session: 2024-2025
Course No.: Chem 1275

Full Title of Course: **Chemistry**

Full Marks: **60**

Time: **03 Hours**

Credit Hours: **3.0**

- * The figures in the margin indicate full marks. The questions are of equal value.
- * Use separate sheet for each section.

Section A

There are **Four** questions in this section. Answer any **Three** questions.

- | | |
|--|--------------|
| 1(a) What were the limitations of Rutherford's atomic model, and how did Bohr overcome these limitations in his atomic theory? | 05 |
| 1(b) State "Pauli's exclusion principle and Azimuthal quantum number with an example. | 05 |
| 2(a) Define "energy bands" in solids. Discuss various band energies with a schematic representation. | 05 |
| 2(b) Discuss the following terms: i) Co-ordination bond, ii) Metallic bonding. | 05 |
| 3(a) What are the main features of the semiconductors and how to prepare an extrinsic semiconductor? | 05 |
| 3(b) Write a note on "Crossed Aldol Condensation" and "Rimer Timan" reactions. | 05 |
| 4(a) Define terms Mole fraction and Normality. | 1.5×2
=03 |
| 4(b) How much weight will be needed to prepare 200 ml of a 0.540 M NaOH solution. | 03 |
| 4(c) Explain the properties of a dilute solution. | 04 |

Section B

There are **Four** questions in this section. Answer any **Three** questions.

- | | |
|--|----|
| 5(a) Explain exothermic and endothermic reactions. Derive the equation $\Delta H = \Delta E + \Delta n RT$, where the symbols have their usual meanings. | 05 |
| 5(b) The heat of combustion of carbon monoxide at constant volume and at 17 °C is -283.3 kJ. Calculate its heat of combustion at constant pressure ($R = 8.314 \text{ J degree}^{-1} \text{ mol}^{-1}$). | 05 |
| 6(a) Establish the following relationship for the first order reaction, where the symbols have their usual meanings: | 05 |
| $k = \frac{2.303}{t_2 - t_1} \log \frac{(a - x_1)}{(a - x_2)}$ | |
| 6(b) Define molecularity of a reaction. Why high molecularity reactions are rare? | 05 |
| 7(a) Establish the relationship between K_c and K_p . | 05 |
| 7(b) The value of K_p at 25 °C for the following reaction is $1.9 \times 10^3 \text{ atm}^{-1}$. Calculate the value of K_c at the same temperature. | 05 |
| $2 \text{ NO (g)} + \text{Cl}_2 \text{ (g)} = 2\text{NOCl (g)}$ | |
| 8(a) How will you determine the emf of a half-cell? | 05 |
| 8(b) What is the potential of a half-cell consisting of zinc electrode in 0.01M ZnSO_4 solution at 25 °C, $E^\circ = 0.763 \text{ V}$. | 05 |

Khulna University, Khulna
Electronics and Communication Engineering Discipline
First Year Second Term Examination, Session: 2024-2025
Course No.: 0714 09 CSE 1251
Full Title of the Course: Object Oriented Programming
Credit Hours: 3.00 Full Marks: 60 Time: 03 Hours

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

- | | |
|--|----|
| 1(a) Explain the SOLID principles in Object-Oriented Design with examples. [L-2; CLO-1] | 03 |
| 1(b) What do you mean by encapsulation, inheritance, and polymorphism? [L-2; CLO-1] | 02 |
| 1(c) Create a class Circle with attributes radius. Write default and parameterized constructors and implement method area(). Overload method circumference() (with and without parameters). [L-3; CLO-3] | 05 |
| 2(a) What is polymorphism? Explain its types. [L-2; CLO-1] | 02 |
| 2(b) Suppose you are designing a Library Management System using Object-Oriented Programming. Write a Java program that: | 08 |
| <div style="margin-left: 40px;"> i) Creates a base class Book with attributes title, author, and price. Include a constructor and a method displayDetails().
 ii) Creates a derived class EBook that inherits from Book and adds an attribute fileSize. Override the method displayDetails() to include file size.
 iii) Override a method calculatePrice() in EBook to apply a 10% discount on the original price. </div> | |
| Write a main() method to create objects of both classes and demonstrate the functionality. [L-3; CLO-3] | |
| 3(a) What is the role of the final keyword in Java? [L-1; CLO-1] | 02 |
| 3(b) What is constructor overloading? Explain with example. [L-2; CLO-1] | 03 |
| 3(c) Explain use of this() and super() using examples. [L-2; CLO-1] | 03 |
| 3(d) What is the output of the following code? [L-3; CLO-5] | 02 |

```

public class Test {
    public static void main(String[] args) {
        int a = 5;
        int b = a++ + ++a + a;
        System.out.println(b);
    }
}

```


- 4(a) Can an abstract class have constructors? Explain briefly. [L-3; CLO-2] 03
- 4(b) Write a Java program: Create an abstract class Appliance with: Method turnOn()
Create an interface SmartDevice with: Method connectToWifi()
Create a class SmartTV that:
Extends Appliance
Implements SmartDevice
Implement all methods
Demonstrate the scenario using main() . [L-4; CLO-2] 05
- 4(c) Write two differences between an abstract class and an interface. [L-1; CLO-1] 02

SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5(a) Explain the life cycle of a thread in Java. Clearly describe all the states a thread goes through from creation to termination. [L-2; CLO-1] 04
- 5(b) Write a Java program where: [L-3; CLO-3] 06
Thread 1 calculates and prints the sum of first 10 natural numbers
Thread 2 calculates and prints the factorial of 5
Ensure both threads run concurrently and display their outputs.
- 6(a) What is an exception in Java? Explain how exceptions are handled using try-catch-finally blocks. [L-1; CLO-4] 04
- 6(b) Differentiate between checked exceptions and unchecked exceptions with examples. [L-2; CLO-5] 03
- 6(c) What will be the output of this code segment and explain the output? [L-3; CLO-5] 03

```
public class Test {
    public static void main(String[] args) {
        try {
            int x = 10;
            int y = x / 2;
            System.out.println("Result: " + y);
            int arr[] = new int[3];
            arr[5] = 100;
            System.out.println("End of try");
        }
        catch (ArithmeticException e) {
            System.out.println("Arithmetic Exception");
        }
        catch (ArrayIndexOutOfBoundsException e) {
            System.out.println("Array Exception");
        }
        finally {
            System.out.println("Finally block");
        }
        System.out.println("Program ends");
    }
}
```


- 7(a) Explain the concept of immutability of Strings. Discuss one advantage and one disadvantage. [L-1; CLO-4] 04
- 7(b) Explain the difference between Vector and ArrayList. [L-2; CLO-1] 03
- 7(c) Describe container and component of awt in java. [L-2; CLO-1] 03
- 8(a) Write a Java program to copy the contents of one file named source.txt into another file named destination.txt. [L-2; CLO-3] 03
- 8(b) Explain the use of FileReader and BufferedReader in Java. How do they improve file reading efficiency? [L-2; CLO-4] 03
- 8(c) What is the output of the following code? [L-2; CLO-4] 02
- ```
String str = "Programming";
System.out.println(str.substring(3, 6));
System.out.println(str.charAt(5));
```
- 8(d) Explain how Java handles exceptions such as IOException and FileNotFoundException with suitable examples. [L-2; CLO-3] 02



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination, Session: 2024-2025**  
**Course No.: CSE 1251 (R)**  
**Full Title of the Course: Object Oriented Programming**  
**Credit Hours: 3.00      Full Marks: 60      Time: 03 Hours**

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

**SECTION A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- |                                                                                                                                                                                                                                                                                                      |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1(a) What are the primary concept that support object-oriented programming?                                                                                                                                                                                                                          | 03 |
| 1(b) What is constructor? Can a class have multiple constructor? Give example.                                                                                                                                                                                                                       | 03 |
| 1(c) Create a class Circle with attributes radius. Write default and parameterized constructors and implement method area(). Overload method circumference() (with and without parameters).                                                                                                          | 04 |
| 2(a) Explain the differences between class and object in OOP.                                                                                                                                                                                                                                        | 02 |
| 2(b) What is polymorphism? Explain its types.                                                                                                                                                                                                                                                        | 03 |
| 2(c) Write a Java program to create a class Student with attributes id, name, and cgpa. Include methods to set and display student details.                                                                                                                                                          | 05 |
| 3(a) What is the purpose of making a variable static? Explain with a proper example.                                                                                                                                                                                                                 | 02 |
| 3(b) Write three differences between abstract class and interface.                                                                                                                                                                                                                                   | 03 |
| 3(c) Write a Java program: Create an abstract class Appliance with: Method turnOn()<br>Create an interface SmartDevice with: Method connectToWifi()<br>Create a class SmartTV that:<br>Extends Appliance<br>Implements SmartDevice<br>Implement all methods<br>Demonstrate the senario using main(). | 05 |
| 4(a) Write a program to demonstrate the use of final keyword.                                                                                                                                                                                                                                        | 02 |
| 4(b) What are packages in Java? Why are they used?                                                                                                                                                                                                                                                   | 03 |
| 4(c) Create a superclaß Shape with a method area (). Create two subclasses: Circle and Rectangle each overriding the area () method.<br>In the main method, show the area of circle and rectangle.                                                                                                   | 05 |



**SECTION B**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5(a) What is an exception? How is it handled in Java? 03
- 5(b) Distinguish between checked and unchecked exceptions. 03
- 5(c) What will be the output of this code segment and explain the output? 04

```
public class Test {
 public static void main(String[] args) {
 try {
 int x = 10;
 int y = x / 2;
 System.out.println("Result: " + y);

 int arr[] = new int[3];
 arr[5] = 100;

 System.out.println("End of try");
 }
 catch (ArithmeticException e) {
 System.out.println("Arithmetic Exception");
 }
 catch (ArrayIndexOutOfBoundsException e) {
 System.out.println("Array Exception");
 }
 finally {
 System.out.println("Finally block");
 }

 System.out.println("Program ends");
 }
}
```

- 6(a) Describe two ways of creating a thread in Java. Give examples using Thread class and Runnable interface. 04
- 6(b) Write a Java program where: 06  
 Thread 1 calculates and prints the sum of first 10 natural numbers  
 Thread 2 calculates and prints the factorial of 5  
 Ensure both threads run concurrently and display their outputs.
- 7(a) Write a Java program to take student information from the keyboard and save it into a file named student.txt. 04
- 7(b) Explain the purpose of IOException and FileNotFoundException in Java file handling. 03
- 7(c) What is awt? List some basic awt components. 03
- 8(a) Distinguish between abstraction and encapsulation. 04
- 8(b) What is the output of the following code? 02  

```
String str = "Programming";
System.out.println(str.substring(3, 6));
System.out.println(str.charAt(5));
```
- 8(c) What are access modifiers in Java? Explain their scopes. 04



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year, Second Term Examination**  
**Session: 2024-2025**  
**Course No.: Chem 1275**  
**Full Title of Course: Chemistry**

Full Marks: 60

Time: 03 Hours

Credit Hours: 3.0

- \* The figures in the margin indicate full marks. The questions are of equal value.
- \* Use separate sheet for each section.

**Section A**

There are **Four** questions in this section. Answer any **Three** questions.

- |                                                                                                                                |              |
|--------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1(a) What were the limitations of Rutherford's atomic model, and how did Bohr overcome these limitations in his atomic theory? | 05           |
| 1(b) State "Pauli's exclusion principle and Azimuthal quantum number with an example.                                          | 05           |
| 2(a) Define "energy bands" in solids. Discuss various band energies with a schematic representation.                           | 05           |
| 2(b) Discuss the following terms: i) Co-ordination bond, ii) Metallic bonding.                                                 | 05           |
| 3(a) What are the main features of the semiconductors and how to prepare an extrinsic semiconductor?                           | 05           |
| 3(b) Write a note on "Crossed Aldol Condensation" and "Rimer Timan" reactions.                                                 | 05           |
| 4(a) Define terms Mole fraction and Normality.                                                                                 | 1.5×2<br>=03 |
| 4(b) How much weight will be needed to prepare 200 ml of a 0.540 M NaOH solution.                                              | 03           |
| 4(c) Explain the properties of a dilute solution.                                                                              | 04           |

**Section B**

There are **Four** questions in this section. Answer any **Three** questions.

- |                                                                                                                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5(a) Explain exothermic and endothermic reactions. Derive the equation $\Delta H = \Delta E + \Delta n RT$ , where the symbols have their usual meanings.                                                  | 05 |
| 5(b) The heat of combustion of carbon monoxide at constant volume and at 17 °C is -283.3 kJ. Calculate its heat of combustion at constant pressure ( $R = 8.314 \text{ J degree}^{-1} \text{ mol}^{-1}$ ). | 05 |
| 6(a) Establish the following relationship for the first order reaction, where the symbols have their usual meanings:                                                                                       | 05 |
| $k = \frac{2.303}{t_2 - t_1} \log \frac{(a - x_1)}{(a - x_2)}$                                                                                                                                             |    |
| 6(b) Define molecularity of a reaction. Why high molecularity reactions are rare?                                                                                                                          | 05 |
| 7(a) Establish the relationship between $K_c$ and $K_p$ .                                                                                                                                                  | 05 |
| 7(b) The value of $K_p$ at 25 °C for the following reaction is $1.9 \times 10^3 \text{ atm}^{-1}$ . Calculate the value of $K_c$ at the same temperature.                                                  | 05 |
| $2 \text{ NO (g)} + \text{Cl}_2 \text{ (g)} = 2\text{NOCl (g)}$                                                                                                                                            |    |
| 8(a) How will you determine the emf of a half-cell?                                                                                                                                                        | 05 |
| 8(b) What is the potential of a half-cell consisting of zinc electrode in 0.01M $\text{ZnSO}_4$ solution at 25 °C, $E^\circ = 0.763 \text{ V}$ .                                                           | 05 |



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**

**First Year Second Term Examination**

**Session: 2024-2025**

**Course No.: 0541 09 Math 1271**

**Full Title of the Course: Differential Equations**

**Full Marks: 60**

**Time: 03 Hours**

**Credits: 3.00**

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

**SECTION A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- |                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1.(a) Bacterial growth is modeled as $\frac{dP}{dt} - kP = 0$ , where, $P$ is the population of bacteria. Suppose a culture has $P_0$ number of bacteria. At $t = 1$ hour the number of bacteria is measured to be $\frac{3}{2}P_0$ . If the rate of growth is proportional to the number of bacteria $P(t)$ present at time $t$ , determine the time necessary for the number of bacterial to triple. [CLO 1,2,3; L3] | 06 |
| 1.(b) Solve $(x^3 + y^2\sqrt{x^2 + y^2})dx - xy\sqrt{x^2 + y^2}dy = 0$ . [CLO 2,3; L4]                                                                                                                                                                                                                                                                                                                                 | 04 |
| 2.(a) Define integrating factor. Solve $(x^2 + y^2 + 1)dx - 2xydy = 0$ . [CLO 1,2,3; L3]                                                                                                                                                                                                                                                                                                                               | 04 |
| 2.(b) Solve $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$ . [CLO 3; L3]                                                                                                                                                                                                                                                                                                                                                  | 03 |
| 2.(c) Solve the Bernoulli's DE $\frac{dy}{dx} + xy = xy^3$ . [CLO 3; L3]                                                                                                                                                                                                                                                                                                                                               | 03 |
| 3.(a) Solve $(D^2 - D + 1)y = x^2 - 3x + 1; D = \frac{d}{dx}$ . [CLO 3; L6]                                                                                                                                                                                                                                                                                                                                            | 03 |
| 3.(b) Solve $(D^2 + 4)y = \cos 2x + e^{3x}$ . [CLO 3; L6]                                                                                                                                                                                                                                                                                                                                                              | 03 |
| 3.(c) Solve $(D^2 + 4D + 4)y = x^2e^{-2x}$ . [CLO 3; L6]                                                                                                                                                                                                                                                                                                                                                               | 04 |
| 4.(a) Solve $y'' + y = \tan x$ by the method of variation of parameters. [CLO 4; L5]                                                                                                                                                                                                                                                                                                                                   | 05 |
| 4.(b) Solve the Cauchy Euler differential equation $(x^2D^2 - 3xD + 4)y = x + x^2\log x$ . [CLO 4; L5]                                                                                                                                                                                                                                                                                                                 | 05 |



## SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5.(a) Solve  $x \frac{d^2y}{dx^2} + (1-x) \frac{dy}{dx} - y = e^x$  by the method of factorization of operators. [CLO 2,3; L5] 05
- 5.(b) Solve the Legendre's differential equation  $(1-x^2) \frac{d^2y}{dx^2} - 2xy' + 2y = 0$ . [CLO 7; L4] 05
- 6.(a) Solve the Bessel's differential equation  $x^2 y'' + xy' + (x^2 - 1)y = 0$ . [CLO 7; L4] 08
- 6.(b) Show that  $\frac{d}{dx} \{J_0(x)\} = -J_1(x)$ . [CLO 2; L5] 02
- 7.(a) Solve the wave equation  $\frac{\partial^2 y}{\partial t^2} = 16 \frac{\partial^2 y}{\partial x^2}$ ,  $0 < x < 2, t > 0$ , subject to the conditions  $y(0, t) = 0$ ,  $y(2, t) = 0, y(x, 0) = 6 \sin \pi x - 3 \sin 4\pi x, y_t(x, 0) = 0, |y(x, t)| < M$  by using separation of variables method. [CLO 2,3; L6] 08
- 7.(b) Find the partial differential equation of  $z = (x^2 + a)(y^2 + b)$ . [CLO 3; L5] 02
- 8.(a) Find the differential equation arising from  $\phi(x + y + z, x^2 + y^2 - z^2) = 0$ . [CLO 3; L5] 03
- 8.(b) Solve the linear partial differential equation  $\frac{y^2 z}{x} P + xzq = y^2; P = \frac{\partial z}{\partial x}, q = \frac{\partial z}{\partial y}$ . [CLO 2,3; L5] 03
- 8.(c) Show that  $\int_{-1}^1 x^n P_n(x) dx = 2^{n+1} \frac{(n!)^2}{(2n+1)!}$ , where  $P_n(x)$  is the Legendre's polynomial. 04  
[CLO 2; L5]



Khulna University, Khulna  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination**

Session: **2024-2025**

Course No.: **Math 1271 (R)**

Full Title of the Course: **Differential Equations**

Full Marks: **60**

Time: **03 Hours**

Credits: **3.00**

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

**SECTION A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 1.(a) Define order and degree of a differential equation. Determine the order, degree and the linearity of the differential equation  $k \frac{d^2 y}{dx^2} = \left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{\frac{3}{2}}$ . 05
- 1.(b) Find the differential equation of the family of curves  $y = e^x (A \cos x + B \sin x)$ , where  $A$  and  $B$  are arbitrary constants. 05
- 2.(a) Convert the following differential equation to its variable separable form and solve it  $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$  05
- 2.(b) Define homogeneous differential equations. Use the solution techniques of a homogeneous differential equation to solve  $y^2 + x^2 \frac{dy}{dx} = xy \frac{dy}{dx}$ . 05
- 3.(a) Define exact differential equation. Solve the following non-exact differential equation:  $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$  05
- 3.(b) Inspect the general solution of the differential equation  $\frac{dy}{dx} + P(x)y = Q(x)$ ; where  $P$  and  $Q$  are constants or functions of  $x$  alone.
- 4.(a) Find the complementary function (CF) of the differential equation with constant coefficients:  $\frac{d^4 y}{dx^4} - \frac{d^3 y}{dx^3} - 9 \frac{d^2 y}{dx^2} - 11 \frac{dy}{dx} - 4y = 0$  05
- 4.(b) Obtain the solution of the non-homogeneous differential equation below:  $(D^2 + 3D + 2)y = e^{2x} \sin x$  05



## SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5.(a) Distinguish between ordinary and partial differential equation. 02
- 5.(b) How many method are there for generating a partial differential equation? Explain. 03
- 5.(c) Use Lagrange's method to find the general solution of the partial differential equation  $y^2(x-y)\frac{\partial z}{\partial x} + x^2(y-x)\frac{\partial z}{\partial y} = z(y^2 + x^2)$ . 05
- 6.(a) Explain the various types of solutions that a differential equation can have. 03
- 6.(b) Discuss the initial and boundary conditions of a differential equation. 02
- 6.(c) Apply the separation of variables method to find the solution of the wave equation. 05
- 7.(a) Inspect and classify the singular points of the differential equation  $x^2(x-2)^2\frac{d^2y}{dx^2} + 2(x-2)\frac{dy}{dx} + (x+1)y = 0$  03
- 7.(b) Use the method of Frobenius to find solutions near  $x = 0$  of the differential equation  $2x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + (x-5)y = 0$ . 07
- 8.(a) Explain Legendre's polynomial. 02
- 8.(b) Prove that the Rodrigue's formula for generating Legendre's polynomial is  $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$  04
- 8.(c) What is Bessel's differential equation? Prove that  $J_{-n}(x) = (-1)^n J_n(x)$ , where  $n$  is a positive integer. 04



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination, Session: 2024-2025**

Course No.: **0231 09 Eng 1281**

Full Title of Course: **English**

Full Marks: **60**

Time: **03 Hours**

Credit Hours: **2.00**

- \* **The figures in the margin indicate full marks. The questions are of equal value.**
- \* **Use separate sheet for each section.**

**Section A**

There are **Four** questions in this section. Answer any **Three** questions.

- |      |                                                                                                                     |              |
|------|---------------------------------------------------------------------------------------------------------------------|--------------|
| 1    | Explain how the intensive reading approach can be effective for learning English grammar and vocabulary. [L2, CLO1] | 10           |
| 2(a) | Use appropriate prepositions to fill in the gaps: [L3, CLO2]                                                        | 1×5<br>=05   |
|      | i) The car ____ us.                                                                                                 |              |
|      | ii) I was born ____ May.                                                                                            |              |
|      | iii) He was relieved ____ his duties.                                                                               |              |
|      | iv) I can agree ____ your proposal.                                                                                 |              |
|      | v) He hesitates ____ nothing.                                                                                       |              |
| 2(b) | Identify the types of subordinate clauses in the following sentences: [L3, CLO1]                                    | 1×5<br>=05   |
|      | i) I can go whenever I want.                                                                                        |              |
|      | ii) I know the boy who won the prize.                                                                               |              |
|      | iii) I learned how it was done.                                                                                     |              |
|      | iv) Do you know that I am an officer?                                                                               |              |
|      | v) Though he knew the answer, he kept silent.                                                                       |              |
| 3    | Explain the following word formation processes with examples: [L5, CLO2]                                            | 2.5×4<br>=10 |
|      | i) Borrowing    ii) Acronym    iii) Compounding    iv) Backformation                                                |              |
| 4(a) | Formulate one word using the following affixes and construct a sentence using each word: [L6, CLO3]                 | 1×5<br>=05   |
|      | i) -tion    ii) -sion    iii) -im    iv) -ly    v) -ous.                                                            |              |
| 4(b) | Explain two rules of intonation in communication. [L5, CLO5]                                                        | 05           |

**Section B**

There are **Four** questions in this section. Answer any **Three** questions.

- |   |                                                                                                                                                     |    |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5 | Explain the features and elements of academic writing. [L2, CLO3]                                                                                   | 10 |
| 6 | Write a dialogue between two students on the benefits of effective communication skills in higher education. [L6, CLO5]                             | 10 |
| 7 | Write an application to the appropriate authority of your university seeking permission and funding for a field trip to a radio station. [L5, CLO5] | 10 |
| 8 | Compose a paragraph on “AI in Digital Communication”. [L5, CLO4]                                                                                    | 10 |



**Khulna University, Khulna**  
**First Year Second Term Examination**  
Session: 2024-2025

**Electronics and Communication Engineering Discipline**  
Course No.: 071409 ECE 1201  
Full Title of the Course: **Electrical Circuits II**  
Full Marks: 60 Time: 03 Hours

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

**SECTION A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 1.(a) What do you mean by mutual reactance, mutual inductance, coefficient of magnetic coupling and mutual induced emf? Consider  $R_a$ ,  $R_b$ , and  $R_c$  of Fig. Q1(a) to be a coupling device between circuit 1 and circuit 2. Show that the coupling impedance between the two circuits is:  $Z_{\text{coupling}} = \frac{(R_a^2 R_b + R_a R_b^2) + j R_c R_b X_c}{(R_a + R_b)^2 + X_c^2}$ . [L3, CLO 1,2] 05

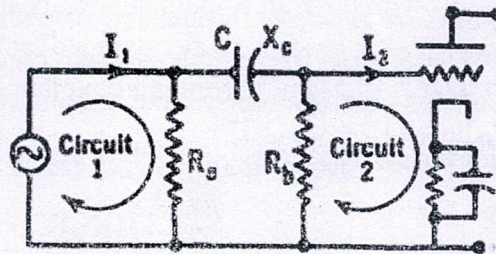


Fig. Q1(a)

- (b) It will be assumed that in Fig. Q1(b):  
 $R_1 = 3.3 \text{ ohms}$ ;  $L_1 = 0.094 \text{ henry}$ ;  $R_2 = 0.775 \text{ ohm}$ ;  $L_2 = 0.0108 \text{ henry}$ ;  
 $M = 0.0256 \text{ henry}$ ;  $Z = 14.5 + j21.2 \text{ ohms}$ ;  $\omega = 377 \text{ r/s}$ ;  $V_1 = 50 \angle 0^\circ \text{ volts}$ .  
Calculate  $I_1$ ,  $I_2$ , and total power dissipated in two circuits. [L3, CLO 1,2] 05

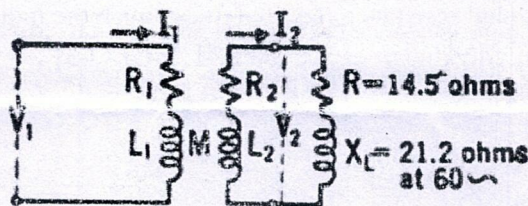


Fig. Q1(b)

- 2.(a) Determine the currents  $I_1$ ,  $I_2$ , and  $I_3$  in the circuit shown in Fig. Q2(a). Also find the energy stored in the coupled coils at  $t = 2 \text{ ms}$ . Assume  $\omega = 1000 \text{ rad/s}$ . [L3, CLO 2] 04

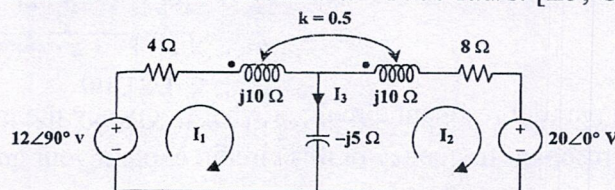


Fig. Q2(a)



- (b) Show that, for  $n$  phase star connected phase the line voltage is  $E_L = 2E_p \sin \frac{180^\circ}{n}$ , where  $E_L$  and  $E_p$  are indicated as line voltage and phase voltage respectively. [L2, CLO 3] 03
- (c) A 220-V, 3- $\phi$  voltage is applied to a balanced delta-connected 3- $\phi$  load of phase impedance  $(15 + j20) \Omega$  (a) Find the phasor current in each line. (b) What is the power consumed per phase? (c) What is the phasor sum of the three line currents? Why does it have this value? [L3, CLO 2] 03
- 3.(a) Show that, the instantaneous value of the three-phase power is independent of time. [L2, CLO 2] 03
- (b) For power measurement in 3 phase load, how do you calculate the reactive voltamperes with two wattmeters. Also describe the procedure for measuring the lagging power factor of an unknown load using the readings of two wattmeter. [L3, CLO 2] 04
- (c) Derive the equation of total current and voltage for a series R-L circuit under such a condition that this is suddenly energized with  $dc$  source. [L2, CLO 3] 03
- 4.(a) What do you mean by time constant in RC circuits? Explain the generation technique of sawtooth waveform using simple transient effect. [L3, CLO 3] 05
- (b) For an R-L-C circuits with  $dc$  source, mathematically show that the behavior of the transient current is oscillatory under loss free (under damped) condition. Also calculate the frequency of the oscillation of this transient current and explain the behavior of the transient current with a necessary figure. [L2, CLO 3] 05

### SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 5.(a) A series resonant circuit will resonate at a frequency of 10 MHz with a fractional bandwidth of 0.25. If the quality factor of the coil at resonance is 20 and its inductance is 50  $\mu H$ , determine:
- The resistance of the coil.
  - The additional resistance required to establish the indicated fractional bandwidth.
  - The required value of capacitance. [L4, CLO 3] 04
- (b) For the network in Fig. 5(b) with  $f_p$  provided:
- Determine  $Q_l$  and  $R_p$ .
  - Calculate  $Z_{Tp}$ .
  - Find  $C$  and  $Q_p$  at resonance. [L3, CLO 3] 04

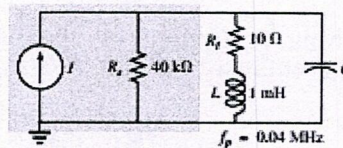


Fig. 5(b)

- (c) For an ideal parallel resonant circuit, at what frequency the maximum impedance occurs? Is it same as the resonant frequency of this circuit, explain your answer? [L2, CLO 3] 02



- 6.(a) For a R-C high pass filter for the value of  $R = 100\Omega$  and  $C = 40\text{ pF}$ , calculate  $A_v = V_o/V_i$  05  
for the frequency range  $f = 0.1 f_c$  to  $20 f_c$  and sketch the magnitude and phase plot.  
[L3, CLO 4]
- (b) A band-pass filter is comprised of a low-pass T-section filter having a cut-off frequency of 05  
15 kHz, connected in series with a high-pass T-section filter having a cut-off frequency of  
10 kHz. The terminating impedance of the filter is 600. Determine the values of the  
components comprising the composite filter. [L4, CLO 4]
- 7.(a) Find the Bode log magnitude and phase angle plot for the following function: 04  
 $A_v = \frac{1-j20/f}{1-j50/f}$ . [L4, CLO 4]
- (b) Find the non-sinusoidal expression for the voltage  $e$ , where  $e = v_1 - v_2$ . 03  
 $v_1 = 20 + 50 \sin 60t + 75 \sin(120t + 90^\circ) + 25 \cos 180t$   
 $v_2 = -10 - 50 \sin(60t + 30^\circ) + 50 \sin(180t + 60^\circ)$ . [L4, CLO 4]
- (c) Determine the symmetry condition of the following waveforms in Fig. 7(c) and find out the 03  
Fourier coefficients present for this type of symmetry conditions. [L4, CLO 5]

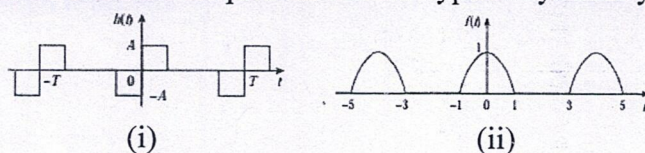


Fig. 7(c)

- 8.(a) Find the Fourier series of the function  $f(t)$  in Fig 8(a). Plot the resultant amplitude and 05  
phase spectra. [L5, CLO 5]

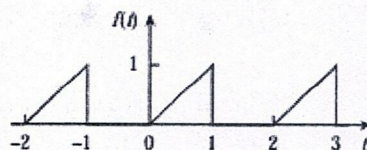


Fig. 8(a)

- (b) The Fourier series representation for the input voltage to the circuit in Fig 8(b) is 05  
 $e = 20 + 35 \sin 200t$ . [L4, CLO 5]
- Find the nonsinusoidal expression for the current,  $i$ .
  - Calculate the rms values of  $i$ ,  $v_R$ , and  $v_L$ .
  - Find the average power deliver to the resistor.

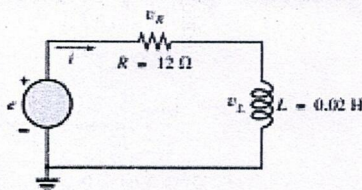


Fig. 8(b)



**Khulna University, Khulna**  
**First Year Second Term Examination**  
Session: 2024-2025

**Electronics and Communication Engineering Discipline**  
Course No.: ECE 1201 (R)  
Full Title of the Course: **Electrical Circuits II**  
Full Marks: 60 Time: 03 Hours

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

**SECTION A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

- 1.(a) What do you mean by coefficient of conductive coupling? For the circuit shown in Fig. Q1(a) calculate,  $I_1$ ,  $I_2$ ,  $I_{12}$  (current in  $Z_{12}$  branch) and total power absorbed by the network. Assume that  $E_1 = 100 \angle 0^\circ$  V,  $Z_1 = 3 + j4 \Omega$ ,  $Z_2 = 4 - j8 \Omega$ , and  $Z_{12} = 10 + j0 \Omega$ . Also draw the vector diagram of  $E$ ,  $I_1$ ,  $I_2$ , and  $I_{12}$ . 05

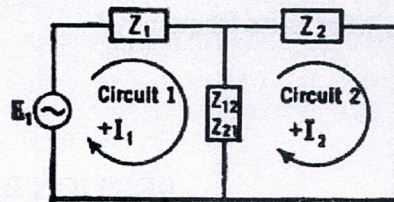


Fig. Q1(a)

- (b) Calculate the mesh currents  $I_1$  and  $I_2$  in the circuit of Fig. Q1(b). Also draw its vector diagram. 05

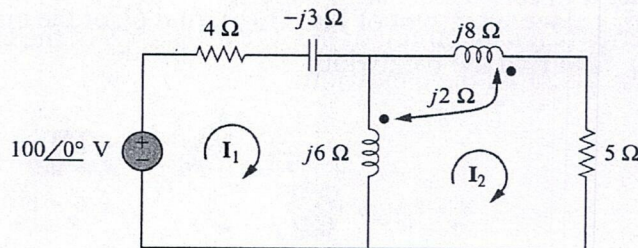


Fig. Q1(b)

- 2.(a) What are the advantages of three-phase systems over other poly-phase configurations in electrical power transmission and distribution? Also explain the generation techniques of three phase delta ( $\Delta$ ) connected voltages with the help of necessary figures and equations. 04
- (b) In a 4-wire, 3-phase system, two phases have currents of 10A and 6A at lagging power factors of 0.8 and 0.6 respectively while the third phase is open-circuited, calculate the current in the neutral and sketch the vector diagram. 03
- (c) For power measurement using two wattmeter method, explain the variations in wattmeter readings for different lagging power factor. Also draw the Watt ratio curve. 03



- 3.(a) Derive the equation of total current and voltage for a series R-C circuit under such a condition that this is suddenly energized with  $dc$  source. 04
- (b) For an R-L-C circuit with a  $dc$  source, mathematically derive the expression for the transient current under the critically damped condition and explain why this current represents the boundary between oscillatory and non-oscillatory behavior. 04
- (c) A coil has 0.1 henry and 1 ohm resistance and carries 10 amperes. If its terminals are suddenly short-circuited, 02
- (i) what will be the value of current 0.1 second later?
- (ii) how long will it take the current to fall to 0.1 ampere?
- 4.(a) Using the method of undetermined coefficient, derive the equation of total current for a series R - L circuit with an input voltage  $v_g \sin \omega t$ . 05
- (b) A  $100\text{-}\mu f$  condenser has a charge of 0.1 coulomb. If it is discharged through a 10,000-ohm resistance, what will be the amount of energy in joules remaining in the condenser 1 second after the discharge is started? 03
- (c) A circuit contains  $R = 5$  ohms,  $L = 0.1$  henry, and  $C = 200 \mu F$  in series. (i) Is the circuit oscillatory? (ii) If so, what is its frequency? 02

### SECTION B

There are FOUR questions in this section. Answer any THREE questions.

- 5.(a) What is the significance of quality factor in resonant circuit? Derive the expressions for quality factor in series resonance circuit. 03
- (b) For the series resonant circuit of Fig. Q5(b), find  $Q_s$  of the circuit, If the resonant frequency is 5000 Hz, also find the bandwidth. 04

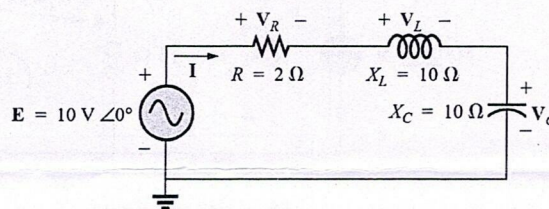


Fig. Q5(b)

- (c) Write the equations for total impedance of a series and parallel resonant circuit and draw the  $Z_T$  versus frequency curves for both cases. 03
- 6.(a) Define power gain and voltage gain. Calculate the output voltage of an amplifier for the applied voltage 200 mV and a dBv gain of 25 dB. 03
- (b) For a R-C high pass filter for the value of  $R = 100 \Omega$  and  $C = 40 pF$ , calculate  $A_v = V_o/V_i$  for the frequency range  $f = 0.1 f_c$  to  $20 f_c$  and sketch the magnitude and phase plot. 04
- (c) Construct a band-pass and band-stop filter using series resonance circuit and sketch the frequency response. 03



- 7.(a) Sketch the bode amplitude and phase plot of the given function:  $A_v = \frac{0.02}{0.02 - j20/f}$  04
- (b) Determine the rms value of the non-sinusoidal voltage,  
 $v = 20 + 15 \sin \omega t + 25 \sin 2\omega t$  and sketch the resultant voltage waveform act as an input. 02
- (c) Find the Fourier series of the function  $f(t)$  in Fig 7(c).

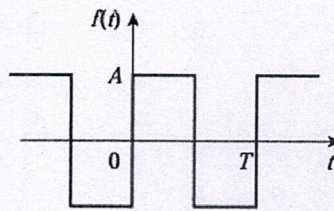


Fig. 7(c)

- 8.(a) Draw the frequency spectrum of the function,  
 $v(t) = 50 + 45.8 \sin \omega t + 37.5 \sin 3\omega t + 29.4 \sin 5\omega t + 22.6 \sin 7\omega t$ . 03
- (b) The Fourier series representation for the input voltage to the circuit in Fig 8(b) is  $e = 20 + 35 \sin 200t$ .
- Find the nonsinusoidal expression for the current,  $i$ .
  - Calculate the rms values of  $i$ ,  $v_R$ , and  $v_L$ .

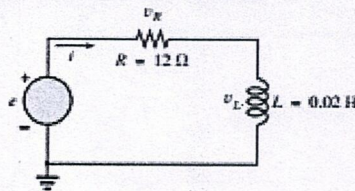


Fig. 8(b)

- (c) Write down the differences between magnetic field and electric field. How do you measure the direction of magnetic flux lines produced by a current carrying conductor? 03



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination, Session: 2024-2025**  
**Course No.: 0314 09 SOC 1283**  
**Full Title of the Course: Sociology**  
**Credit Hours: 3.00      Full Marks: 60      Time: 03 Hours**

- The figure in the margin indicates full marks. The questions are of equal value.
- Use separate sheet for each section.

### SECTION A

There are **FOUR** questions in this section. Answer any **THREE** questions.

- |                                                                                               |    |
|-----------------------------------------------------------------------------------------------|----|
| 1(a) What are the necessities of studying Sociology for the ECE graduates? [L-2; CLO-1]       | 04 |
| 1(b) Discuss the functionalist and conflict theoretical properties of Sociology. [L-3; CLO-1] | 06 |
| 2(a) What are the differences between Society and community? Explain. [L-2; CLO-1]            | 04 |
| 2(b) Define Sociology. [L-1; CLO-1]                                                           | 03 |
| 2(c) Identify the agents of socialization. [L-3; CLO-2]                                       | 03 |
| 3(a) Explain the development of culture around the world. [L-2; CLO-1]                        | 05 |
| 3(b) What are the elements of structure? Interpret. [L-2; CLO-1]                              | 05 |
| 4(a) What do you understand by division of labor? [L-2; CLO-2]                                | 02 |
| 4(b) Analyze the determinants of social stratification. [L-3; CLO-2]                          | 04 |
| 4(c) Explain the dimensions of social inequality. [L-2; CLO-2]                                | 04 |

### SECTION B

There are **FOUR** questions in this section. Answer any **THREE** questions.

- |                                                                                                |    |
|------------------------------------------------------------------------------------------------|----|
| 5(a) What are the impact of technology on social change? Illustrate with example. [L-2; CLO-3] | 05 |
| 5(b) Explain how industrialization brought social change across the world. [L-3; CLO-3]        | 05 |
| 6(a) Briefly discuss Sociological properties of mass media and communication. [L-3; CLO-4]     | 05 |
| 6(b) Interpret the major forms of collective behavior. [L-2; CLO-4]                            | 05 |
| 7(a) What do understand by crime? [L-2; CLO-4]                                                 | 02 |
| 7(b) Analyze the major causes of juvenile delinquency. [L-3; CLO-4]                            | 04 |
| 7(c) Examine the relation between population and environment. [L-2; CLO-4]                     | 04 |
| 8(a) What do understand by neo-colonialism? [L-2; CLO-5]                                       | 02 |
| 8(b) Inspect the major causes behind unemployment and poverty in Bangladesh. [L-3; CLO-5]      | 04 |
| 8(c) Is violence against women a social problem of Bangladesh? Analyze. [L-3; CLO-5]           | 04 |



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination, Session: 2024-2025**  
**Course No.: 071409 ECE 1203**  
**Full Title of Course: Bipolar and Unipolar Devices and Circuits**  
**Full Marks: 60      Time: 03 Hours      Credit Hours: 3.00**

- \* The figures in the margin indicate full marks. The questions are of equal value.
- \* Use separate sheet for each section.

**Section A**

There are **Four** questions in this section. Answer any **Three** questions.

- 1(a) What do you mean by the energy level of the materials? With the help of necessary figures explain the energy levels in isolated atomic structures, conduction and valence bands of an insulator, a semiconductor, and a conductor. [L2, CLO 1] 04
- 1(b) With the help of necessary figures and equations, explain the characteristics of depletion region in a semiconductor diode under forward and reverse bias conditions. Also describe the generating principle of reverse saturation current with necessary figures. [L1, CLO 1] 03
- 1(c) How does the figure shown in Fig. 1(c) connect with the operation of a practical diode? Explain the diode working principle according to this figure. [L3, CLO 1] 03

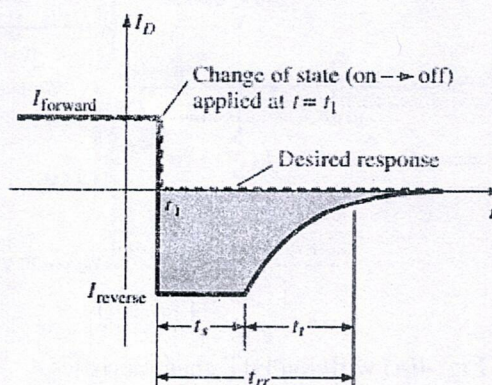


Fig. 1(c)

- 2(a) Determine the output level for the positive logic AND gate of Fig. 2(a). Also calculate the value of current through the R of the Fig. 2(a). [L3, CLO 1] 2.5

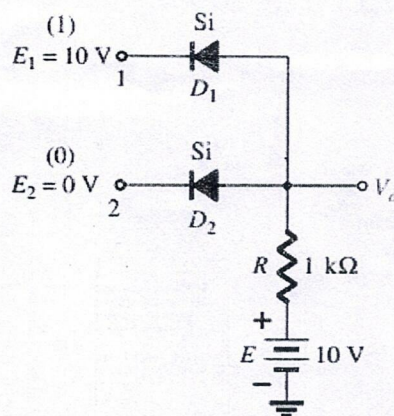


Fig. 2(a)



2(b) Sketch the output  $v_o$  for the networks of Fig. 2(b). [L3, CLO 1]

3\*1.5  
= 4.5

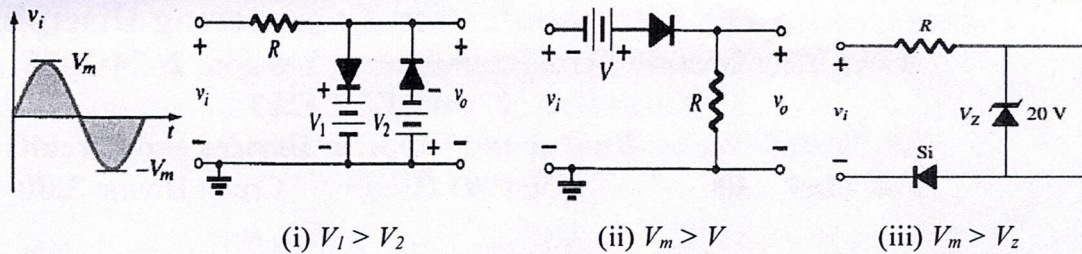


Fig. 2(b)

2(c) Illustrate the circuit topology of a bridge-type full-wave rectifier using four diodes and a load resistor ( $R_L$ ). Plot the input and output voltage waveforms on the same time-domain axis, clearly indicating the peak voltage ( $V_m$ ) and the period ( $T$ ) of each signal. [L2, CLO 1]

03

3(a) Sketch the basic construction of PNP and NPN bipolar junction transistor and label the various minority and majority carriers in each. Also explain the source of the leakage current in a transistor? [L2, CLO 2]

03

3(b) Provide the formulas for the following parameters of bipolar junction transistor (BJT). (i)  $I_E$  (ii)  $\alpha_{dc}$  (iii)  $\beta_{dc}$  (iv) relationship between  $\alpha$  and  $\beta$ . [L2, CLO 2]

02

3(c) Determine  $V_C$  and  $V_B$  for the network of Fig. 3(c). [CLO 2, L5]

05

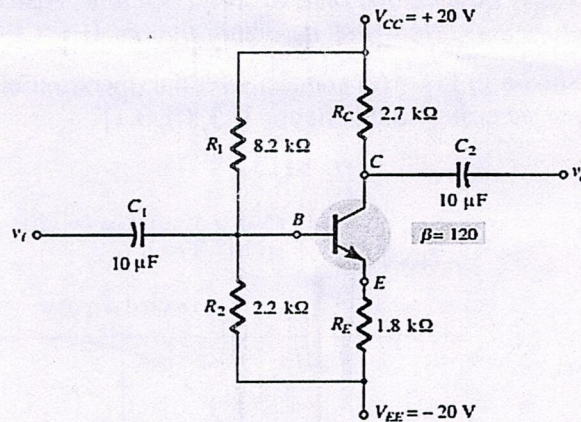


Fig. 3(c)

4(a) Given the network of Fig. 4(a) with the BJT characteristics.

03

- Draw the load line for the network on the characteristics.
- Determine the dc beta in the center region of the characteristics. Define the chosen point as the Q-point.
- Using the dc beta calculated in (ii), find the dc value of  $I_B$ .
- Find  $I_{CQ}$  and  $V_{CEQ}$ . [L2, CLO 2]

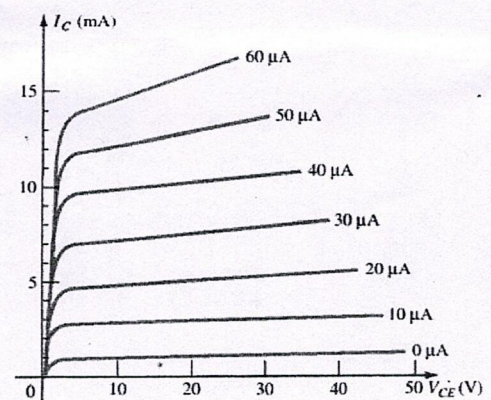
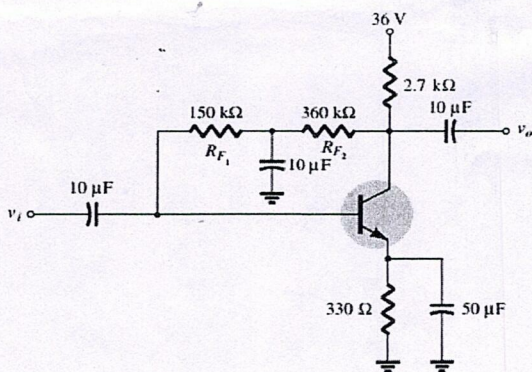


Fig. 4(a)



4(b) Determine  $V_C$  and  $V_B$  for the network of Fig. 4(b). [L3, CLO 2]

03

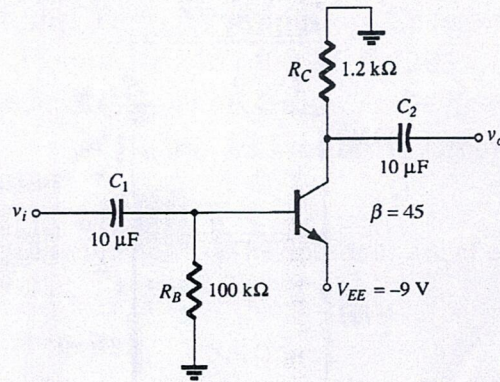


Fig. 4(b)

4(c) For the circuit shown in Fig. 4(c), find  $h_{re}$  in terms of the CB  $h$  parameters. [L3, CLO 2]

04

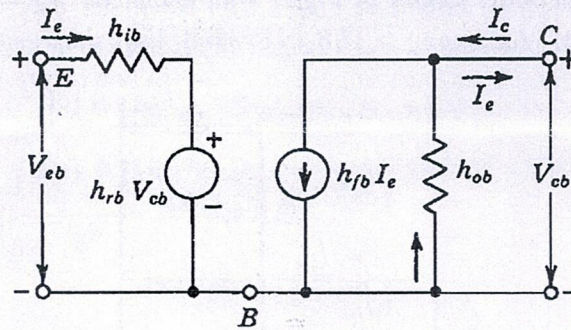


Fig. 4(c)

### Section B

There are **Four** questions in this section. Answer any **Three** questions.

- 5(a) Describe in your own words how a JFET can be used as a voltage-controlled resistor. [CLO 3, L2] 02
- 5(b) Why is the terminology 'field effect' appropriate for FET? [CLO 3, L1] 02
- 5(c) For the circuit of Fig. 5(c) with the following parameters:  $I_{DSS} = 8\text{mA}$ ,  $V_P = -4\text{V}$ ,  $V_{DD} = 16\text{V}$ ,  $R_1 = 2.1\text{M}\Omega$ ,  $R_2 = 270\text{k}\Omega$ ,  $R_D = 2.4\text{k}\Omega$ , and  $R_S = 1.5\text{k}\Omega$ , determine the following:  $V_{GSQ}$ ,  $I_{DQ}$ ,  $V_D$ ,  $V_S$ ,  $V_{DS}$ , and  $V_{DG}$ . [CLO 3, L5] 06

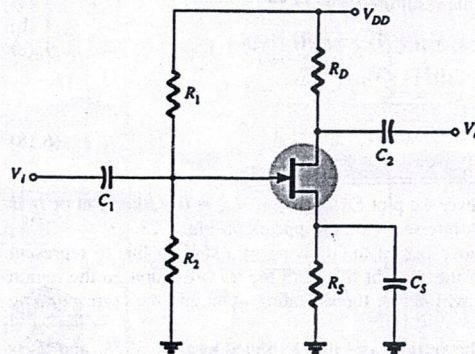


Fig. 5(c)

- 6(a) Explain in your own words why the application of a positive voltage to the gate of an n-channel depletion-type MOSFET will result in a drain current exceeding  $I_{DSS}$ . [CLO 4, L2] 02



- 6(b) For the voltage divider bias configuration of Fig. 6(b), determine the following:  $V_{GSQ}$ ,  $I_{DQ}$ ,  $V_D$ ,  $V_G$ ,  $V_S$ , and  $V_{DS}$ . [CLO 4, L5] 08

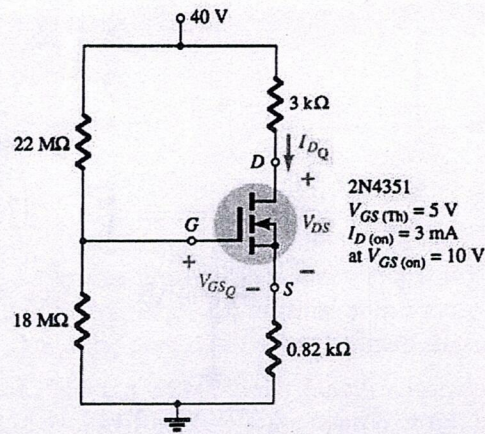


Fig. 6(b)

7. For the JFET amplifier circuit of Fig. 7 with parameter  $g_m = 2.2 \text{ mS}$ , determine:  $Z_i$ ,  $Z_o$ ,  $Z'_o$ ,  $A_v = \frac{V_o}{V_i}$ ,  $A_i = \frac{I_o}{I_i}$  and  $V_o$ . Assume  $r_d > 10R_D$ . [Symbols have their usual meaning] [CLO 3, L5] 10

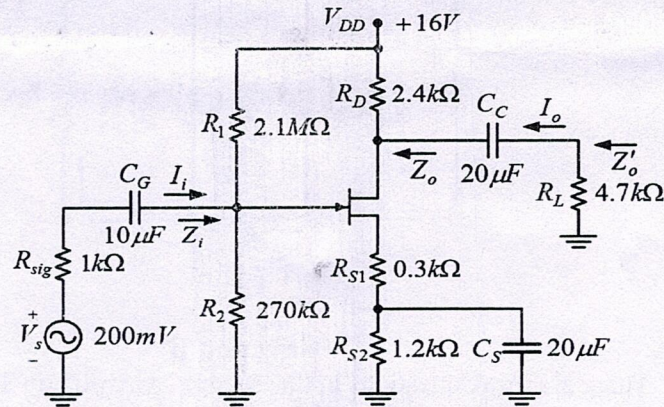


Fig. 7

8. For the JFET amplifier circuit shown in Fig. 8, with the following parameters:  $I_{DSS} = 8 \text{ mA}$ ,  $V_P = -4 \text{ V}$ ,  $r_d > 10R_D$ ,  $C_{gd} = 2 \text{ pF}$ ,  $C_{gs} = 4 \text{ pF}$ ,  $C_{ds} = 0.5 \text{ pF}$ ,  $C_{W_i} = 5 \text{ pF}$ , and  $C_{W_o} = 6 \text{ pF}$ . [CLO 3, L5] 6+4 = 10

- Determine  $f_L$ ,  $f_H$ , and  $BW$ .
- Sketch the frequency response.

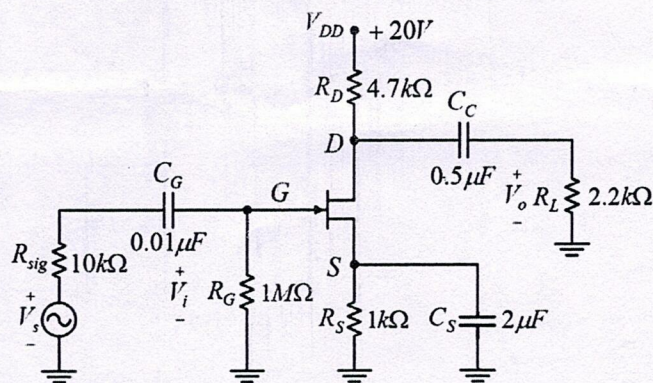


Fig. 8



**Khulna University, Khulna**  
**Electronics and Communication Engineering Discipline**  
**First Year Second Term Examination, Session: 2024-2025**  
**Course No.: ECE 1203**  
**Full Title of Course: Electronic Circuits-I**  
**Full Marks: 60      Time: 03 Hours      Credit Hours: 3.00**

- \* The figures in the margin indicate full marks. The questions are of equal value.
- \* Use separate sheet for each section.

**Section A**

There are **Four** questions in this section. Answer any **Three** questions.

- 1(a) How do dopants affect the electrical properties of a semiconductor, and what are some common dopants used in the industry? Also explain how do metals conduct electricity, and what is the mechanism behind their high conductivity? 03
- 1(b) What do you mean by Process of electroluminescence? Explain the physical process that occurs within a p-n junction to produce light. Why are specific materials like Silicon not ideal for this purpose? 03
- 1(c) For the given circuit and input waveform in Fig. 1(c), sketch the output waveform. 04

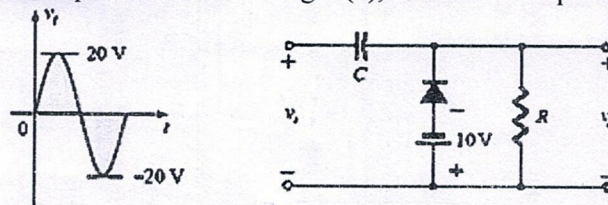


Fig. 1(c)

- 2(a) Determine the output waveform for the network of Fig. 2(a) and calculate the output dc level and the required PIV of each diode. 03

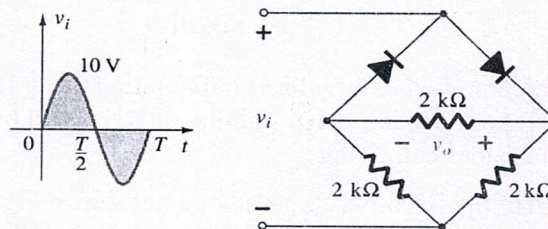


Fig. 2(a)

- 2(b) Determine the output level for the positive logic OR gate of Fig. 2(b). Also calculate the value of current through the R of the Fig. 2(b). 04

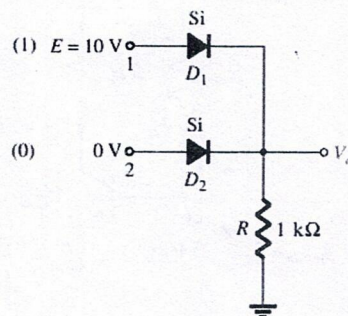


Fig. 2(b)



2(c) For the network of Fig. 2(c), Determine the currents  $I_1$ ,  $I_2$ , and  $I_{D2}$ .

03

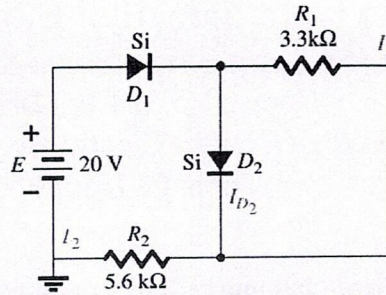


Fig. 2(c)

3(a) Define Current Amplification Factor for CE, CC, CB Configuration

03

3(b) Define the boundaries of the linear operating region for a BJT. Provide the mathematical expressions that ensure the device stays within its rated current ( $I_C$ ), voltage ( $V_{CE}$ ), and power dissipation ( $P_C$ ) limits to avoid distortion or thermal failure.

03

3(c) Determine the following for the configuration shown in Fig. 3(c). (i)  $I_{BQ}$  and  $I_{CQ}$ , (ii)  $V_{CEQ}$ , (iii)  $V_B$  and  $V_C$ , and (iv)  $V_{BC}$ .

04

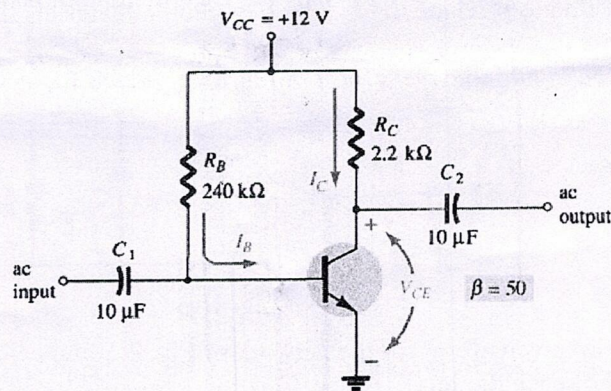


Fig. 3(c)

4(a) Draw the circuit diagram of an emitter bias configuration using BJT. Also show that this type of biasing configuration provides improved stability of BJT when outside conditions, such as temperature and transistor beta, change.

03

4(b) Complete the design of the fixed-bias transistor circuit shown Fig. 4(b), by determining  $R_C$  and  $R_B$  for a Q-point of  $I_C = 6$  mA and  $V_{CE} = 4$  V. The transistor forward current gain is  $\beta_F = 200$ . Let  $V_{BE} = 0.7$  V.

03

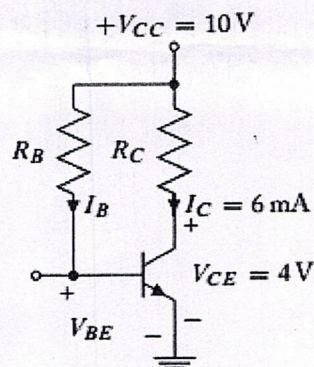


Fig. 4(b).

4(c) Define as a partial derivative (i)  $h_{ie}$ ; (ii)  $h_{fe}$ ; (iii)  $h_{re}$ ; and (iv)  $h_{oe}$ . Indicate what variable is held constant and give the dimensions of each  $h$  parameter.

04



### Section B

There are **Four** questions in this section. Answer any **Three** questions.

- 5(a) Describe in your own words why  $I_G$  is effectively zero amperes for a JFET transistor. 02
- 5(b) Why is the terminology 'field effect' appropriate for FET? 02
- 5(c) For the network of Fig. 5(c),  $V_D = 9\text{ V}$ . Determine: 06
- (i)  $I_D$ , (ii)  $V_S$  and  $V_{DS}$ , (iii)  $V_G$  and  $V_{GS}$ , (iv)  $V_P$ .

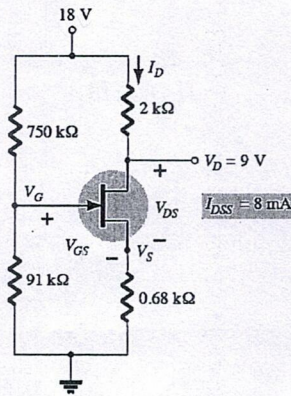


Fig. 5(c)

- 6(a) Sketch the basic construction of an n-channel depletion-type MOSFET and explain its basic operation. 04
- 6(b) For the common-gate configuration of Fig. 6(b), determine the following:  $V_{GSQ}$ ,  $I_{DQ}$ ,  $V_D$ ,  $V_G$ ,  $V_S$ , and  $V_{DS}$ . 06

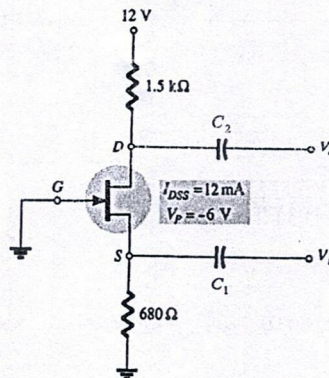


Fig. 6(b)

- 7(a) If a JFET having a specified value of  $r_d = 100\text{ k}\Omega$  has an ideal voltage gain of  $A_v = -200$ , what is the value of  $g_m$ ? 02
- 7(b) Design the self-bias network of Fig. 7(b) to have a gain of 10. The device should be biased at  $V_{GSQ} = \frac{1}{3}V_P$ . 08

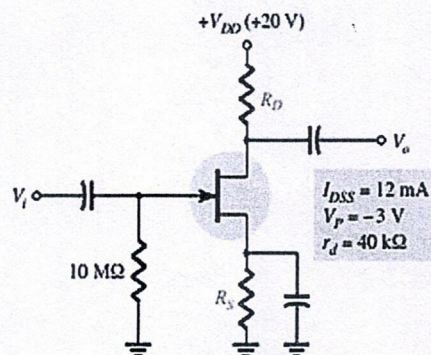


Fig. 7(b)



- 8(a) For a transformer coupled class A amplifier, explain dc bias operation and ac operation. Also show that maximum efficiency of transformer coupled class A amplifier is 50%. 04
- 8(b) Calculate the efficiency of a class B amplifier for a supply voltage of  $V_{CC} = 24 \text{ V}$  with peak output voltages of: (i)  $V_L(p) = 22 \text{ V}$ . (ii)  $V_L(p) = 6 \text{ V}$ . 03
- 8(c) Draw the block diagram showing different parts of a power supply. Also explain the operations of each block. 03