

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
Department of Computer Science and Engineering
1st Year 2nd Semester B.Sc. (Engg.) Final Examination-2023
CSE 1201: Digital Logic Design (3 Credits)

Time: 3 Hours

Full Marks: 70

Instructions

- Figures shown in the right margin indicate full marks.
- Answer 5 out of 7 questions.

Question-1

- a. Simplify the following boolean expression using boolean algebra. 2

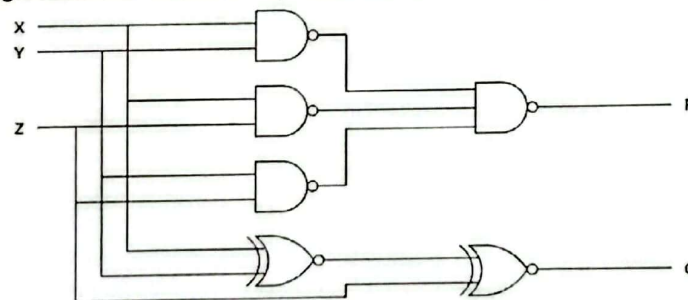
$$A\bar{B} + (\bar{A} + \bar{B} + C.\bar{C})$$

- b. Prove De Morgan's law using a truth table for four variables. 4
- c. Illustrate the implementation of the XOR gate using the NOR gate only. 4
- d. Convert the following to the other canonical form. 4

$$F(A, B, C, D) = \Sigma (0, 2, 6, 11, 13, 14)$$

Question-2

- a. Express the boolean function $F=A+B'C$ as a sum of minterms. 4
- b. The logic circuit below has three inputs, X, Y, and Z, and two outputs, F and G. 6



Find the minterm list and maxterm list representations for the outputs F and G. Show the details calculation.

Function	Minterm list	Maxterm list
F	$\Sigma_{XYZ} (\quad)$	$\Pi_{XYZ} (\quad)$
G	$\Sigma_{XYZ} (\quad)$	$\Pi_{XYZ} (\quad)$

- c. Describe implicants, prime implicants, and essential prime implicants with examples. 4

Question-3

- a. Simplify the following Boolean function by using ^{five}four-variable maps. 6

$$F(A, B, C, D, E) = \Sigma(0, 1, 4, 5, 16, 17, 21, 25, 29)$$

- b. Minimize the following equation using Quine-McCluskey method. 8

$$f(A, B, C, D, E) = \Sigma(1, 4, 12, 14, 16, 18, 21, 25, 26, 29, 31) + d(0, 2, 5, 30)$$

Question-4

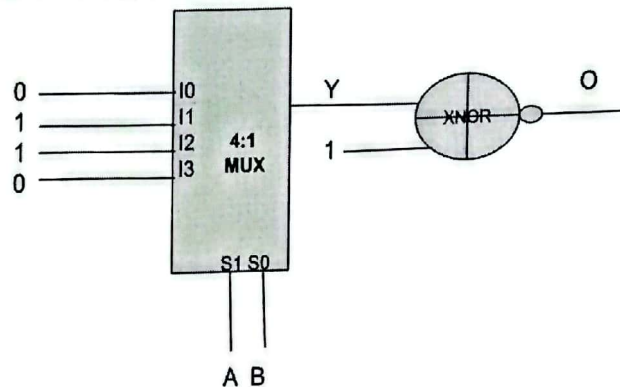
- Write down the main difference between a combinational and sequential circuit. Draw the block diagram and describe the working principle of 8 bit full adder. 3
- Describe the working principle and draw a 4 bit carry look ahead adder. 3
- Implement and describe the following functions using a decoder and two OR gates. 4

$$F1(x, y, z) = \Sigma(1, 2, 5, 7)$$

$$F2(x, y, z) = \Sigma(4, 5, 7)$$
- Design a combinational circuit whose input is a four-bit number and whose output is the 2's complement of the input number. 4

Question-5

- Design and implement a 32x1 MUX using 8x1 MUX. 5
- Consider the following diagram consisting of a 4:1 MUX and XNOR gate. Justify the following statement as true or false. Explain the reason behind your answer. 6



- $O(A, B) = \Sigma(1, 2)$
- $O(A, B) = \Pi(0, 3)$
- XOR gate with A and B as input
- $A'B' = AB$

- "The decoder can be used as a demultiplexer."-Justify this statement whether it is valid or not? If it is valid, then describe the settings/scenarios required for that. 3

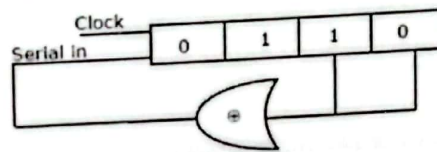
Question-6

- Write down the difference between latch and flip flop. What are the ways to solve the race around problem. 3
- Show the steps to convert the SR flip flop to the T flip flop. 3
- Write down the difference between negative edge triggering and positive edge triggering. Design a 4-bit asynchronous down counter. 4
- Draw the logic diagram and state diagram of the BCD ripple counter. 4

Question-7

- Draw the logic diagram and discuss the 3 bit synchronous up counter. 4

- b. I. A serial in/parallel out, 4-bit shift register initially contains all 1s. The data nibble 0111 is waiting to be entered. After four clock pulses, determine the contents of the register. 6
- II. The bit sequence 10011100 is serially entered (right-most bit first) into an 8-bit parallel out shift register that is initially clear. What are the Q outputs after four clock pulses?
- c. The initial contents of the 4-bit serial in serial out, right shift, shift register are 0110, which is shown in figure. After how many clock pulses will the contents of the shift register be 0110 again? Show the details of the steps in your calculation. 4



Time: 3 Hours

Full Marks: 70

INSTRUCTIONS

- Answer 05 out of 07 questions
- Figures in the margin indicate full marks

Question-1

- Discuss the importance of type casting in programming. Explain the differences between implicit and explicit type casting, providing examples of each. Additionally, explain how improper type casting leads to issues in a program 4
- Explain the difference between static and dynamic memory allocation. 4
- Write a program that dynamically allocates memory for an array of integers, allows the user to input values, and then calculates and prints the sum of the elements. 6

Question-2

- State the difference between standard header files and user-defined header files. 4
- Create two files: `main.c` and `math_operations.h`. In `math_operations.h`, declare functions `add (int, int)`, `subtract (int, int)`, `multiply (int, int)`, and `divide (int, int)`. In `main.c`, include the header file, implement these functions, and write a program that calls each function, displaying the result for two integers input by the user. 4
- Write a program that calculates the power of a number `a` raised to an exponent `b` (i.e., `a^b`) using a loop without using built-in power functions. 6

Question-3

- Explain the purpose of the `const` keyword. How does using constants improve code safety and readability? 4
- Explain the difference between predefined (or built-in) data types and user-defined data types. 4
- Explain why a `break` statement is crucial in a Switch Case Structure. 2
- Describe the process of identifying a leap year in C language. 4

Question-4

- What are dangling pointers and memory leaks? How do they occur, and what programming practices can help prevent them? 4
- Write a program in C language to determine the number of words in a given string. For simplicity, it can be assumed that, there are no white spaces as well the words are separated by a single space. For example: the number of words in the string "I love my country" is 4. 4
- Consider an array of `n` positive integers named `arr`, where the values do not exceed 100. Write a program that creates another array called `count`, where `count[i]` stores the frequency of the integer `i` in `arr`. For instance, if `arr = {2, 3, 5, 2, 5, 5}`, then `count[2]` will be 2, `count[3]` will be 1, and `count[5]` will be 3. The other indices in the `count` array will remain 0. Additionally, explain how this `count` array can be utilized to sort the `arr` array. 6

Question-5

- Define scope in programming. Explain the difference between local and global variables, and discuss how scope rules affect variable accessibility. 4

- b. What will be the output of the following code?

```
#include <stdio.h>

int countDown(int *n) {
    static int count = 0;
    if (*n <= 0) return count;
    count++;
    (*n)--;
    return countDown(n);
}

int main() {
    int x = 15;
    printf("Total function calls: %d\n", countDown(&x));
    return 0;
}
```

- c. What is the purpose of functions in structured programming? How do they contribute to program modularity and reusability?

6

Question-6

- a. Define recursion in programming. Write a recursive function `int fibonacci (int n)` that returns the *n*th Fibonacci number. Explain how the recursive calls work in the program's memory.
- b. Explain the concept of recursive depth and its limitations. How does excessive recursion affect program performance? How to mitigate it?

6

8

Question-7

- a. Describe the purpose of *fopen*, *fclose*, *sprintf*, and *fscanf*. Provide examples of how they are used to read from and write to files.

4

- b. Write down the output of the following code snippet.

4

```
#include <stdio.h>
int main() {
    int a[5] = {2, 7, 4, 9, 3}, b = 6, i;
    int *p = a, *q = p, *r = &b;
    *q *= *r;
    *(q+1) = *q + 5;
    p+=2;
    *p = 10;
    for(i=0; i<5; i++)
    {
        printf("%d ", *q**p);
        q++;
    }
    return 0;
}
```

- c. Consider the following two structures:

6

```
struct Result{
    float credit, cgpa;
}

struct Student{
    int roll;
    Result r;
}
```

Now consider that, there is an array of *Student* of size *n* in the main function of a program written in C language. Now sort the array according to the *cgpa* of each student in descending order. If the *cgpa* of two *Student* are equal then sort them according to their *roll* in ascending order.

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Department of Computer Science and Engineering

1st Year 2nd Semester B. Sc. (Engg.) Final Examination-2023

Course Code: MAT 1205 Course Title: Linear Algebra

Total Marks: 70 Time: 3 Hours Credits: 3

N.B.: Answer any 05 questions out of 07 questions.

[6]

1. (a) Solve by Gauss-Jordan elimination

$$\begin{aligned}x_1 + 3x_2 - 2x_3 + 2x_5 &= 0, \\2x_1 + 6x_2 - 5x_3 - 2x_4 + 4x_5 - 3x_6 &= -1, \\5x_3 + 10x_4 + 15x_6 &= 5, \\2x_1 + 6x_2 + 8x_4 + 4x_5 + 18x_6 &= 6.\end{aligned}$$

[4]

- (b) Find all the positive integers solution of $x_1 - 2x_2 + 7x_3 = 4$.

[4]

- (c) Prove that the matrix $A = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & i \\ -i & -1 \end{pmatrix}$ is unitary.

2. (a) Find the values of k for which the matrix A is invertible, where $A = \begin{bmatrix} 1 & 2 & 0 \\ k & 1 & k \\ 0 & 2 & 1 \end{bmatrix}$

[4]

- (b) By examining the determinant of the coefficient matrix, show that the following system has a nontrivial solution if and only if $\alpha = \beta$.

[4]

$$\begin{aligned}x + y + \alpha z &= 0 \\x + y + \beta z &= 0 \\\alpha x + \beta y + z &= 0\end{aligned}$$

- (c) Solve by Cramer's rule, where it applicable.

[6]

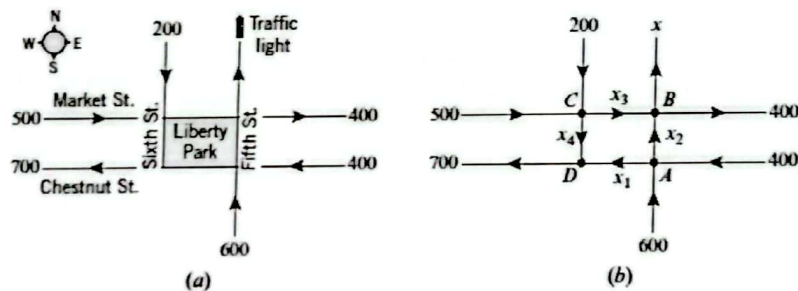
$$\begin{aligned}-x_1 - 4x_2 + 2x_3 + x_4 &= -32 \\2x_1 - x_2 + 7x_3 + 9x_4 &= 14 \\-x_1 + x_2 + 3x_3 + x_4 &= 11 \\x_1 - 2x_2 + x_3 - 4x_4 &= -4\end{aligned}$$

3. (a) For which values of k will the following system of equations have exactly one solution, more than one solution, and no solution [6]

$$\begin{aligned}x + 2y - 3z &= 4 \\3x - y + 5z &= 2 \\4x + y + (k^2 - 14)z &= k + 2.\end{aligned}$$

- (b) The network in the following figure shows a proposed plan for the traffic flow around a new park that will house the Liberty Bell in Philadelphia, Pennsylvania. The plan calls for a computerized traffic light at the north exit on Fifth Street, and the diagram indicates the average number of vehicles per hour that are expected to flow in and out of the streets that border the complex. All streets are one-way. [8]

- (i) How many vehicles per hour should the traffic light let through to ensure that the average number of vehicles per hour flowing into the complex is the same as the average number of vehicles flowing out?
- (ii) Assuming that the traffic light has been set to balance the total flow in and out of the complex, what can you say about the average number of vehicles per hour that will flow along the streets that border the complex?



4. (a) When can two matrices be multiplied? Prove that $(AB)^t = B^t A^t$, where ' t ' stands for transpose. [4]

- (b) Find the symmetric and skew-symmetric parts of the matrix $\begin{pmatrix} 1 & 2 & 4 \\ 6 & 8 & 1 \\ 3 & 5 & 7 \end{pmatrix}$. [4]

- (c) Using 'adjoint' of a matrix find the matrix A if $(4A)^{-1} = \begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & 0 \\ 3 & -1 & 4 \end{pmatrix}$. [6]

5. (a) Define the basis and dimension of a vector space. Determine a basis for and the [7]

dimension of the solution space of the homogeneous system

$$\begin{aligned} 2x_1 + 2x_2 - x_3 + x_5 &= 0, \\ -x_1 - x_2 + 2x_3 - 3x_4 + x_5 &= 0, \\ x_1 + x_2 - 2x_3 - x_5 &= 0, \\ x_3 + x_4 + x_5 &= 0. \end{aligned}$$

- (b) Define least squares error. Find the least squares solutions, the least squares error vector, and the least squares error of the linear system [7]

$$\begin{aligned} 3x_1 + 2x_2 - x_3 &= 2, \\ x_1 - 4x_2 + 3x_3 &= -2, \\ x_1 + 10x_2 - 7x_3 &= 1. \end{aligned}$$

6. (a) Define symmetric matrix. Find the all values of a, b and c when the following matrix is symmetric. [5]

$$\begin{pmatrix} 2 & a - 2b + 2c & 2a + b + c \\ 3 & 5 & a + c \\ 0 & -2 & 7 \end{pmatrix}$$

- (b) Find the Euclidean distance between the vectors $\underline{u}$ and $\underline{v}$ if [5]

$$\underline{u} = (1 - i, 1 + i, 2i, 3), \underline{v} = (4 + 6i, -3i, -1 + i, i).$$

- (c) Show that every basis of finite dimensional vector space has the same number of vectors. [4]

7. (a) Determine whether the polynomials $p_1(t) = 1 - t$, $p_2(t) = -2t^2 + 3t + 5$ and $p_3(t) = -t^2 + 3t + 1$ are linearly dependent or not. [4]

- (b) Define eigenvalues and eigenvectors of a matrix. Find a matrix P that diagonalizes [10]

$$A = \begin{bmatrix} 0 & 0 & -2 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}.$$

Also, find A^{13} .

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
Department of Computer Science and Engineering
1st Year 2nd Semester B.Sc. (Engg.) Final Examination-2023
EEE 1207: Electrical Circuits (3 Credits)

Full Marks: 70

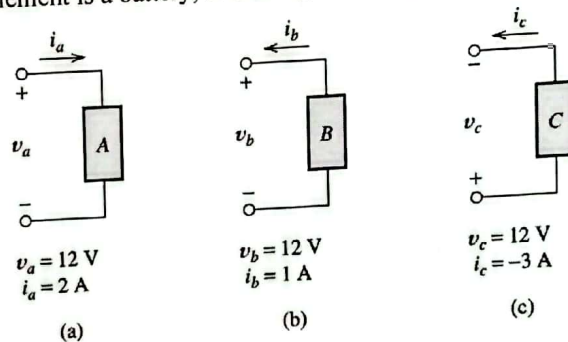
Time: 3 Hours

Instructions

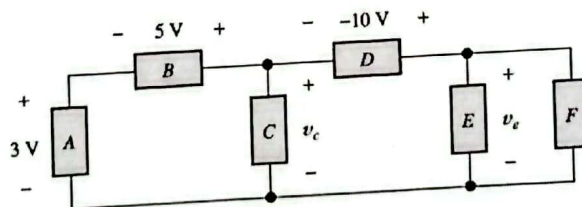
- Figures shown in the right margin indicate full marks.
- Answer 5 out of 7 questions.

Question-1

- a. Suppose that charge versus time for a given circuit element is given by $q(t) = 0$ for $t < 0$ and $q(t) = 2 - 2e^{-100t}$ C for $t > 0$. Sketch $q(t)$ and $i(t)$ to scale versus time. 4
- b. Consider the circuit elements shown in Figure below. Calculate the power for each element. If each element is a battery, is it being charged or discharged? 6

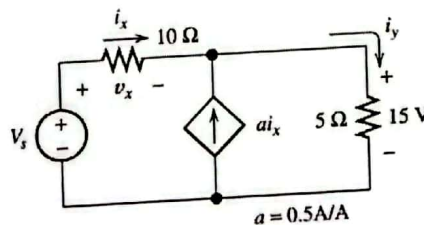


- c. Use repeated application of KVL to find the values of v_c and v_e for the circuit of Figure below: 4



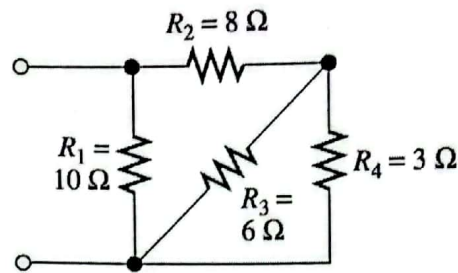
Question-2

- a. Solve for the source voltage in the circuit of Figure below in which we have a current-controlled current source and we are given that the voltage across the 5Ω resistance is 15 V. 5



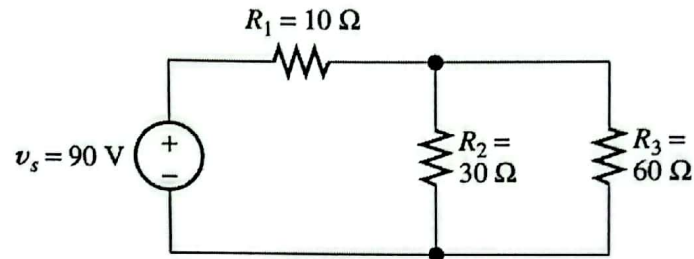
- b. Find the equivalent resistance for the network shown in Figure below.

4



- c. Find the current, voltage, and power for each element of the circuit shown in Figure below.

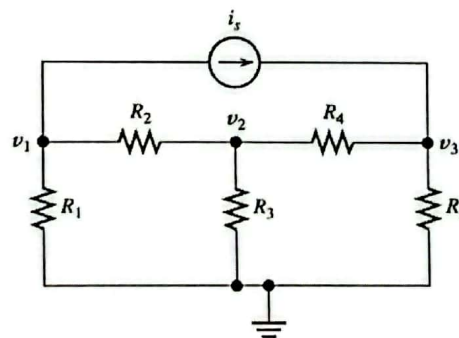
5



Question-3

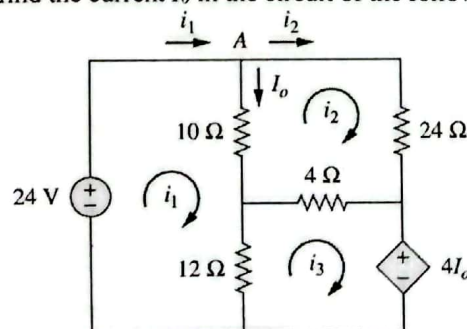
- a. Write equations that can be solved for the node voltages v_1 , v_2 , and v_3 shown in Figure below.

7



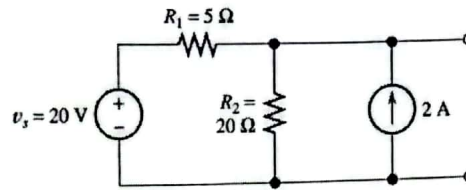
- b. Use mesh analysis to find the current I_o in the circuit of the following Figure.

7

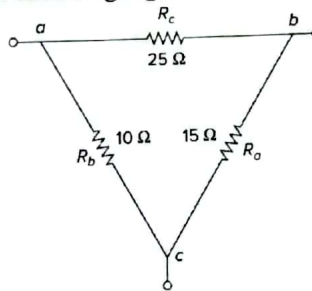


Question-4

- a. Find the Thévenin resistance for the circuit shown in Figure below by zeroing the sources. Then, find the short-circuit current and the Thévenin equivalent circuit. 7



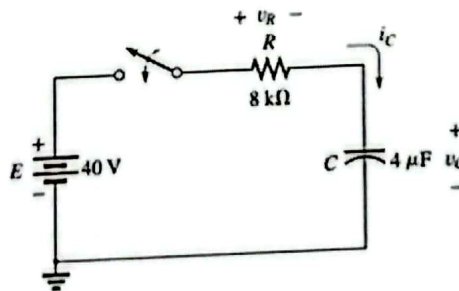
- b. Convert the Δ network in the following Figure to an equivalent Y network. 7



Question-5

For the circuit in Figure below:

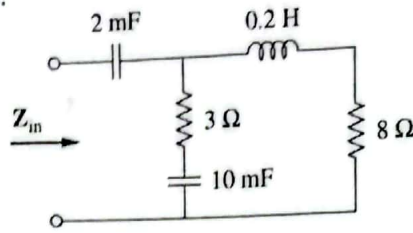
- a. Find the mathematical expression for the transient behavior of v_c , i_c , and v_R if the switch is closed at $t = 0$ s.
 b. Plot the waveform of v_c versus the time constant of the network.
 c. Plot the waveforms of i_c and v_R versus the time constant of the network.
 d. What is the value of v_c at $t = 20$ ms?
 e. On a practical basis, how much time must pass before we can assume that the charging phase has passed? 14



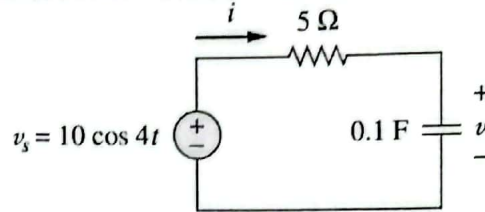
Question-6

- a. A voltage $v_c(t) = 100 \cos(200t)$ is applied to a $100 \mu\text{F}$ capacitance. Find the impedance of the capacitance, the phasor current, and the phasor voltage. Also, draw the phasor diagram. 5

- b. Find the input impedance of the circuit in the following Figure. Assume that the circuit operates at $\omega = 50 \text{ rad/s}$. 4

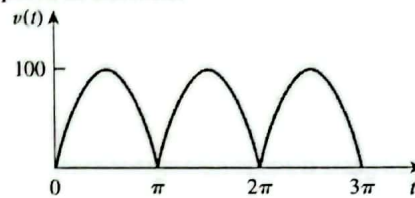


- c. Find $v(t)$ and $i(t)$ in the circuit shown in the following figure. 5

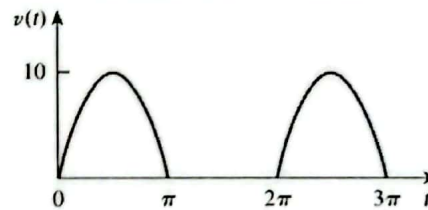


Question-7

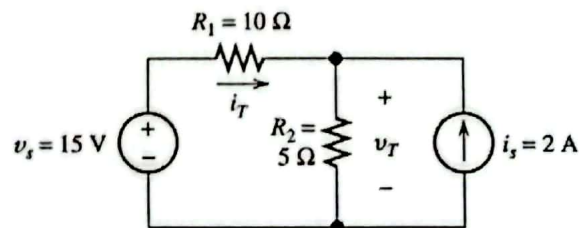
- a. Find the rms value of the full-wave rectified sine wave in the following figure. Calculate the average power dissipated in a resistor. 3



- b. The waveform shown in the following figure is a half-wave rectified sine wave. Find the rms value and the amount of average power dissipated in a resistor. 3



- c. Use superposition in solving the circuit shown in Figure below for the voltage v_T . 8



Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
Department of Computer Science and Engineering
1st Year 2nd Semester B.Sc. (Engg.) Final Examination-2023

GED 1209: Bangladesh Studies (3 Credits)

Time: 3 Hours

Full Marks: 70

INSTRUCTIONS

- a. Answer **05** out of **07** questions
- b. Figures in the margin indicate **full marks**

- 1
 - a. What were the reasons behind the Sepoy Mutiny of 1857? 7
 - b. Why did the Sepoy Mutiny fail to secure victory? Discuss. 7
- 2
 - a. How did the Bengalis respond to the decision by the rulers that Urdu should be the only state language of Pakistan? 7
 - b. How did the political landscape in East Pakistan change after the language movements of 1952? Discuss. 7
- 3
 - a. Mention the successes of the first government of Bangladesh after independence in 1971. 7
 - b. Analyze the challenges faced by the first government of Bangladesh. 7
- 4
 - a. What is social structure? 7
 - b. Examine the key features of the social structure in Bangladesh. 7
- 5
 - a. Mention three areas where the progress of women in Bangladesh has been extraordinary. 7
 - b. What is meant by female subordination? What challenges do female members encounter in local government in Bangladesh? 7
- 6
 - a. What is meant by political economy? What are the reasons for laborers' dissatisfaction in Bangladesh's garment industry? 7
 - b. Assess the effects of laborer dissatisfaction on the economy of Bangladesh. 7
- 7
 - a. Analyze the impact of social media on the youth of Bangladesh. 7
 - b. What differences in the impact of social media are visible in the youth of rural and urban areas? Discuss. 7