

Electronic Devices and Circuits

North East University Bangladesh

Department of Computer Science and Engineering

Mid Semester Examination Summer-2023 Semester

Program: B.Sc. (Engg.) in CSE

Course: CSE-06131213 (Electronic Devices and Circuits)

Total Marks: 30

Total Time: 1 Hr 30 mins

Instructions: Answer all the parts in question no 1, 3 parts from question no 2 and 3.

Write your answers neatly with only adequate amount of explanations and diagrams where necessary. If not required avoid unnecessary explanation. Unnecessary materials will gain no marks but can lose marks if it contradicts with actual answers. In all mathematical questions you must show all the steps.

Figures in the margin indicate full marks. Answer parts of a question together.

1. a) Fill in the gaps with appropriate term(s). 2
 - i. Majority carrier in a p-type material is _____.
 - ii. The breakdown during reverse bias of a semiconductor diode can be due to Zener effect or _____ effect.
 - iii. _____ semiconductor material is used in construction of white LED.
 - iv. Current through a diode in forward bias is approximately _____ times that of reverse bias. [Provide a numerical value]
- b) Answer these questions in 1 line. 6
 - i. Draw the energy band diagram of semiconductor and conductor.
 - ii. What is the significance of the knee voltage in a diode?
 - iii. What is the difference between majority carrier and minority carrier in semiconductor material?
 - iv. What is reverse recovery time?
 - v. Write down the Shockley's equation.
 - vi. What is carrier mobility of a semiconductor material?
- c) How does temperature affect the characteristics of a diode? Explain with proper diagrams. 3
- d) Design a full wave rectifier circuit using two diodes and explain its working. 4

(Total for Question 1 = 15 Marks)

2. Answer any three (3) of the following questions.

- a) Using the characteristics of figure 1, determine I_D , V_D , and V_o for the circuit in figure A. 3

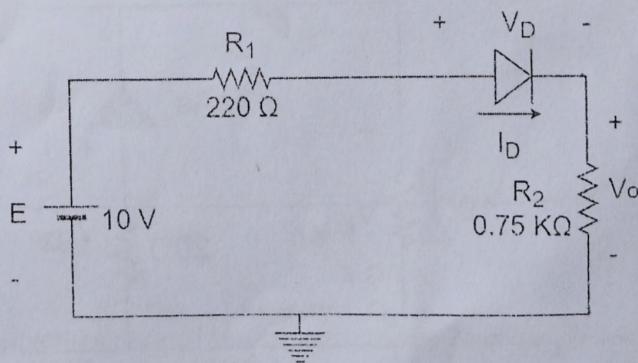


Figure A

- b) Design a 4.8V voltage regulator using Zener diode. Show proper workings. 3

- c) For the circuit in figure B, find (i) V_D (ii) V_O (iii) I_D

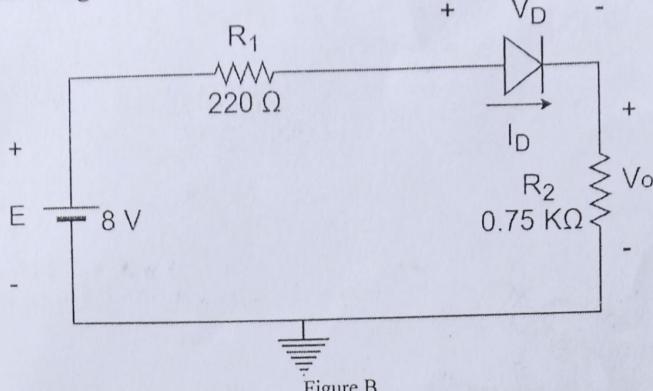


Figure B

- d) For the circuit in figure C find the output voltage and current.

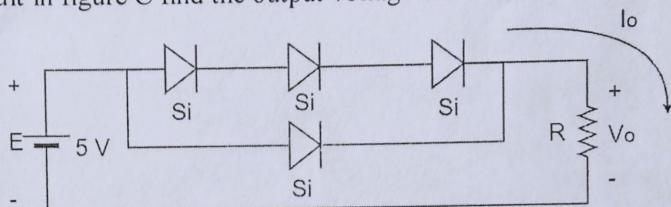


Figure C

- e) Draw the output for the circuit in figure D.

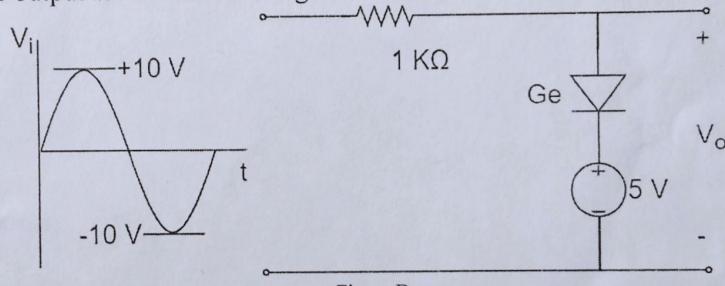


Figure D

- f) What is a clamper circuit? Will a clamper circuit work for any frequency signal at input? [You need to provide detailed explanation for the second part of the question]

- g) For the circuit in figure D, find the marked voltages and current.

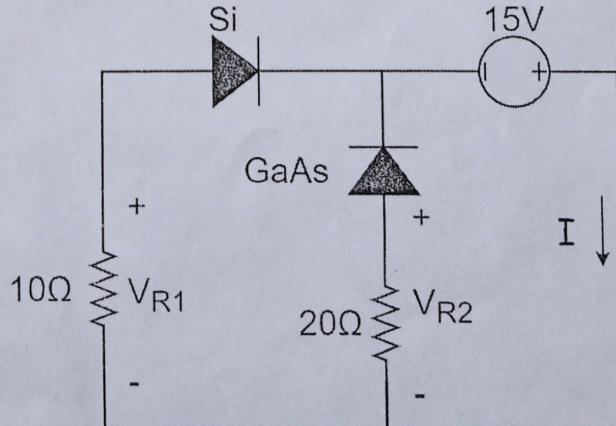


Figure E

- h) Explain the working principle of a pnp BJT with proper diagram.

(Total for Question 2 = 9 Marks)

3. Answer any **three (3)** of the following questions.
- What is the difference between intrinsic and extrinsic semiconductor.
 - Find the value of resistor required to drive 2 BLUE LEDs in series with a supply of 10V such that they operate at their nominal 20 mA current.
 - Using the I-V characteristics of figure 2, find the dynamic resistance of the diode operating at 1.15V.
 - Explain how electron-hole recombination process leads to decrease in the size of depletion layer in a PN junction.
 - Usually LEDs are driven at maximum of 20 mA current. If you drive LED at a current substantially higher than 20 mA, will the lifespan of the LED increase or decrease? Explain your choice.
 - Draw the symbols of p channel JFET and Zener diode.
 - What frequency of EM radiation will be provided by a PN junction during the recombination process when the energy gap is 5.3 eV?
- (Total for Question 3 = 6 Marks)

Data necessary for answering questions

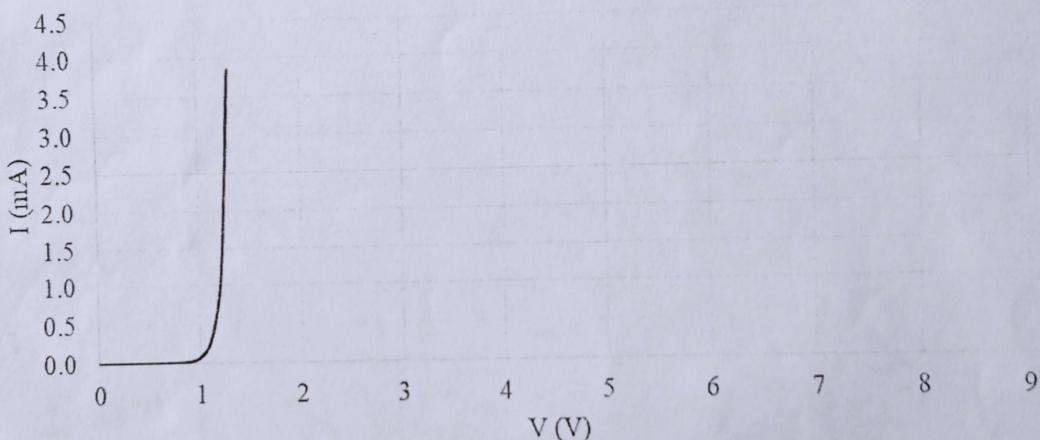


Figure 1: I-V characteristics for question 2a

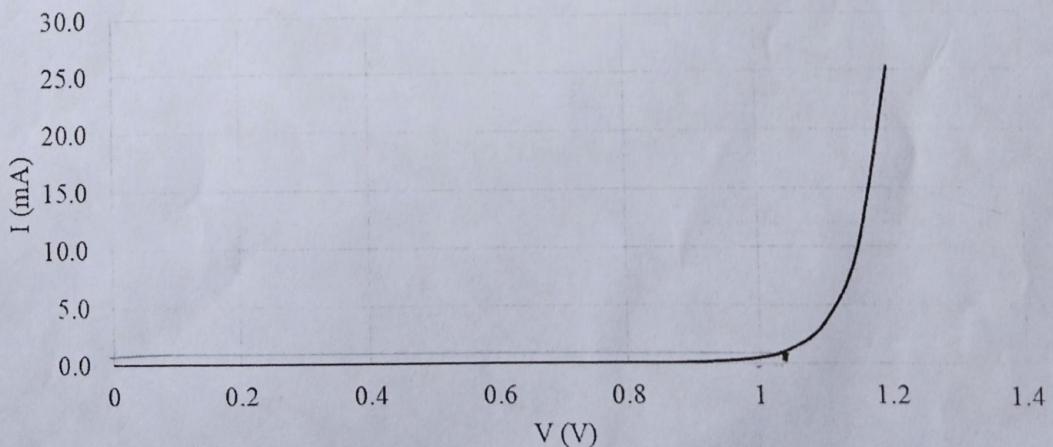


Figure 2: I-V characteristics for question 3c

You must submit the question paper if you answer question 2a and/or 3c with your answer script.
In such case write your registration number below

Reg no: _____

Advanced Functional English

North East University Bangladesh

Program: BSc. (Engineering) in Computer Science

Department of Computer Science and Engineering

Mid Semester Examination, Summer 2023

Course Code: ENG 02321201

Course Title: Advanced Functional English

Time: 1 hour 30 minutes

Marks: 30

✓ 1. Identify the sentences on the basis of their structure: 05

- a) She spoke very strongly and you listened to her.
- b) If you read, you will learn.
- c) Because of his illness, he could not attend the meeting.
- d) The man who is reported is a spy.
- e) I saw that the boy was playing.

✓ 2. Use the correct form of verb that follows causative verb: 05

- a) I got the work—— (do).
- b) You need to get your hair—— (cut).
- c) We got our servants ——— (wash) our living room.
- d) He made me—— (driven) the car.
- e) Let him ——— (choices) what he likes.

✓ 3. Complete the sentences according to the basic rules of conditional sentence: 05

- a) If he has time, _____.
- b) If I had had the wings of a bird, _____.
- c) Ice melts, _____.
- d) Hadn't he studied hard, _____.
- e) He would go mad, _____.

Please turn over

4. Read the passage and write the antonym and synonym of the words as directed bellow:

05

Reaching the summit of Mount Everest is a dream for numerous adventurers, but it demands immense determination and cautious planning. The intense cold and scarcity of oxygen at such high altitudes pose a huge challenge. Yet, amidst the rage of nature, there is a genuine sense of amity among climbers, displaying incredible acts of kindness and support. The immense beauty of the Himalayan landscape reminds us to be kind and more careful towards the Earth's abundant resources.

- a) Summit (antonym) b) Numerous (synonym) c) Immense (synonym) d) Cautious (antonym) e) Intense (synonym) f) Scarcity (antonym) g) Rage (synonym) h) Genuine (antonym) i) Kind (synonym) j) Abundant (antonym)

5. Write a paragraph within 250 words from the following topics:

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- a) The Digital Revolution: Transforming Bangladesh into a Smart Nation
- b) Global Warming

Linear Algebra

North East University Bangladesh

Department of Computer Science & Engineering

B.Sc. (Engg.) in CSE Program

Mid Semester Examination, Summer-2023

Course Code: MAT-05411203, Course Title: Linear Algebra

Full Time: 1.5 Hours

Credit: 03

Marks: 30

[N.B.: Answer any three (03) from the following questions. Figure in the right margin indicate full marks.
Fraction of all questions must answer sequentially.]

1. a) Define complex conjugate, Idempotent and Nilpotent matrices with example. 4
b) Using the matrices: 6

$$A = \begin{bmatrix} 5 & 2 \\ 3 & -8 \\ 2 & 6 \end{bmatrix}, \quad B = \begin{bmatrix} 8 & 5 \\ 4 & 7 \end{bmatrix}, \text{ and } C = \begin{bmatrix} 4 & 7 \\ 2 & 8 \end{bmatrix}, \text{ verify that } A(B+C) = AB + AC.$$

2. a) Find the Adjoint and the inverse matrix of the following matrix: 7

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

- b) What do you mean by Homogeneous and Non-homogeneous linear equation? Write down the linear system which has no solution. 3

3. a) Mention the difference between Echelon Form and Row Reduced Echelon form. 2
b) Find the Echelon Form and Row Reduced Echelon Form of the following matrix: 8

$$A = \begin{bmatrix} 1 & 2 & -1 & 2 & 1 \\ 0 & 0 & 3 & -6 & 1 \\ 0 & 0 & 5 & -12 & 2 \end{bmatrix}$$

4. a) Define dot or scalar product of two vectors, distance and norm or length in \mathbb{R}^n . 4
b) For any vectors 6

$x, y, z \in \mathbb{R}^n$ and any scalar $\alpha, \beta \in \mathbb{R}$. Prove that

$$(i) x + y = y + x \text{ and (ii)} (\alpha\beta x) = \alpha(\beta x)$$

5. a) Write down the statement of the Cauchy-Schwarz inequality and Minkowski's inequality. 2
b) Write down the algorithm of Gaussian elimination method. Solve the following system of linear equations using the method of Gaussian elimination. 8

$$x_1 + 2x_2 + 3x_3 + 2x_4 = -1$$

$$-x_1 - 2x_2 - 2x_3 + x_4 = 2$$

$$2x_1 + 4x_2 + 8x_3 + 12x_4 = 4$$

Bangladesh Studies

North East University Bangladesh

Program: BSc. (Engg.) in CSE

Department of Computer Science and Engineering

Mid-Semester Examination, Summer 2023

Course Code: SSW-03141202

Course Title: Bangladesh Studies

Time: 1 hour 30 minutes

Marks: 30

(Answer any three of the following questions. Figures in the right margin indicate full marks.)

1. a) What is a society? 1
b) Write the present social system in Bangladesh. 4
c) Describe the Oraon ethnic group in Bangladesh. 5
2. a) Write the nature of the economy of Bangladesh. 4
b) What is planned migration? 2
c) Write the impacts of international migration on the economy of Bangladesh. 4
3. a) What is cultural lag? 2
b) How many factors drive cultural change? and explain each factor. 5
c) What are the social problems due to cultural lag? 3
4. a) What is NGOs? 1
b) Write the classification of NGOs on the basis of role. 4
c) What are the positive and negative effects of NGOs? Explain. 5
5. a) What is population change? 1
b) What factors influence population change? Explain. 4
c) What is morbidity? Write about the difference between self-perceived morbidity and observed morbidity. 5

Data Structures and Algorithm

North East University Bangladesh
Department of Computer Science and Engineering
Mid Semester Examination, Summer-2023
Program: B.Sc. (Engg.) in CSE
Course: CSE-06131211 (Data Structures and Algorithms)

Total Marks: 30

Total Time: 1 Hr 30 mins

Instructions: Answer any three questions from the following.

Figures in the margin indicate full marks. Answer parts of a question together.

- ✓ a) Write the output of the following code: 5

```
int main()
{
    int a = 10, *p, *q, *r;
    p = &a;
    q = p;
    r = p;
    printf("%d %d %d\n", *p, *q, *r);
    *q = 20;
    printf("%d %d %d", *p, *q, *r);
}
```

- ✓ b) What is the time complexity of the following code? 5

```
int main()
{
    int i, j, n, sum=0, mul=3, result;
    scanf("%d", &n);
    for(i=0; i<n; i++){
        for(j=0; j<n; j++){
            sum = sum+1;
            mul = mul*2;
            result = sum+mul;
        }
    }
    for(i=0; i<n, i++){
        sum=sum-1;
    }
    printf("result %d %d", result, sum);
}
```

2. a) What is the time complexity of bubble sort? 1
b) Write the pseudocode to find an element from a sorted array using binary search. 4
c) Sort the following sequence of numbers in ascending order using insertion sort. 5
Show all the steps.

12, 31, 25, 8, 32, 17

- ✓ 3. a) What is the purpose of a "head" pointer in a linked list? 1
b) What is a linked list, and how does it differ from an array in data structures? 1+3
c) Write the pseudocode to create and print the singly linked list having three elements. 5

4. Consider the following queue, where **Queue** is a circular array whose size is 6.
(write Overflow or Underflow if they occur in any operation)
Front = 1, Rear = 3, Queue:

	8	23	15		
--	---	----	----	--	--

- a) Describe the **Queue** as the following operations taking place sequentially? 5
1. Insert 10.
2. Insert 29.
3. Delete two elements from the queue.
4. Insert 2.
5. Insert 30.
- b) Describe the scenario if the **Queue** is a normal one? 5

- ✓ 5. a) Consider the following operations on an empty stack, draw the state of the stack at each step and find out the top element of the stack after all operations are completed. 5
1. push(25)
2. push(29)
3. pop()
4. push(20)
5. pop()
6. push(30)
7. push(9)
8. push(15)
9. pop()
- b) Explain the concepts of **stack overflow** and **stack underflow** in the context of a stack data structure? 2
- c) What data structures can be used to implement a stack? What are the differences between Stack and Queue data structure? 1+2

Fundamentals of Physics



North East University Bangladesh, Sylhet
Department of Computer Science and Engineering
Mid Semester Examination Summer-2023 Semester
Program: B.Sc. (Engg.) in CSE
Course: PHY-05331201 (Fundamentals of Physics)

Total Marks: 30

Time: 1 Hour 30 Minutes

Instructions: Answer any three questions from the following.

Figures in the margin indicate full marks. Answer parts of a question together.

1. (a) Define instantaneous acceleration from average acceleration in two dimension? Which one is more useful? (3+1)
- (b) The coordinates(meters) of the rabbit's position as function of time t (seconds) are $x = -0.3t^2 + 7t + 28$ and $y = 0.4t^2 - 9t + 30$. Find in unit vector notation at $t = 8s$, of rabbit's (i) position vector \vec{r} ? (ii) velocity \vec{v} ? (iii) acceleration \vec{a} ? (6)
2. (a) State Newton's laws of motion. (3)
- (b) Define momentum of an object of mass m and velocity \vec{v} and explain the conservation of momentum of an object from newton's second law. (1+2)
- (c) A stream of bullets whose mass m is each 4g fired horizontally with a speed v of 1200 m/s into a large wooden block of mass M (=12kg) that is initially at rest on a horizontal table. If the block is free to slide without friction across the table, what speed will it acquire after it has absorbed 8 bullets? (4)
3. (a) Explain Newton's law gravitation. (2)
- (b) At what altitude above the Earth's surface is the free-fall acceleration equal to 7.35 m/s² (three-quarters of its value at the surface)? (2)
- (c) Explain Kepler's laws of planetary motion. (6)
4. (a) Derive the differential equation of simple harmonic oscillation from restoring force of the form $F = -kx$, where the symbols have their usual meaning. (1)
- (b) Displacement of the form $x(t) = A \sin(\omega t + \phi)$ satisfy the differential equation of simple harmonic oscillation. (3)
- (c) Draw the graph of position versus time, velocity versus time and acceleration versus time over the time period if the displacement of simple harmonic oscillator is $x(t) = A \sin \omega t$. (6)
5. Consider an travelling wave $y = 0.25 \cos(3.14x - 628t)$, all are in S.I. units. (2)
- (a) Distinguish between travelling wave and standing wave. (2)
- (b) Calculate amplitude, frequency, wavelength and wave velocity using the above expression. (4)
- (c) Generate standing wave from the above travelling wave.. (4)