

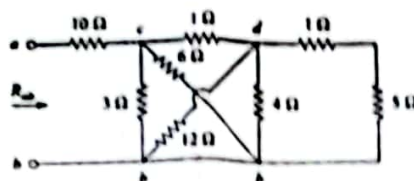
Metropolitan University, Sylhet
 Department of Computer Science and Engineering
 Summer Term Final Examination – 2022
 Program: B.Sc. in CSE; Batch: 57
 Course: CSE 123: Basic Electrical Engineering

Time: 2 Hours

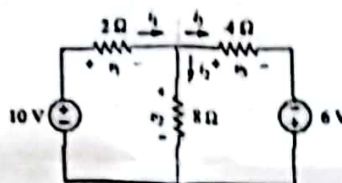
Marks: 40

**Answer any four questions. All parts of each question must be answered sequentially.
 Figures in the right margin indicate full marks.**

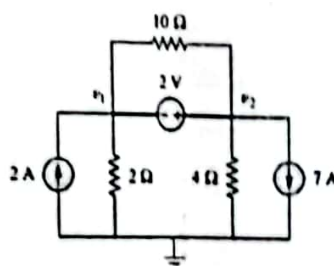
1. a) Calculate the equivalent resistance R_{ab} from the following circuit. 5



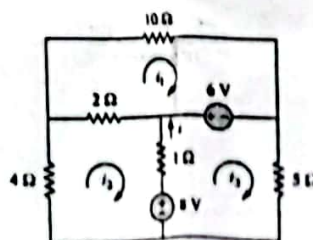
- b) Find the currents and voltages in the circuit shown below. 5



2. a) For the circuit shown in figure below, find the node voltages. 5



- b) Apply mesh analysis to find i in the figure below. 5



3. a) What is Integrator and Differentiator? Define it with a proper diagram. 2+2
 b) Find C_{eq} for Fig 3(a) and L_{eq} for Fig 3(b) 3+3

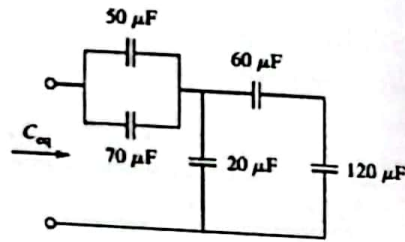


Fig 3(a)

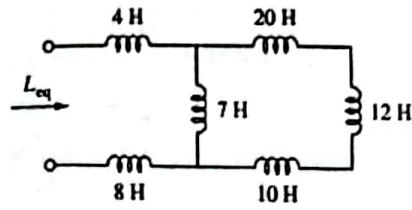
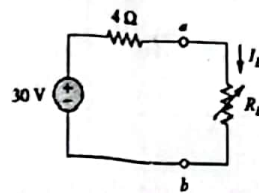
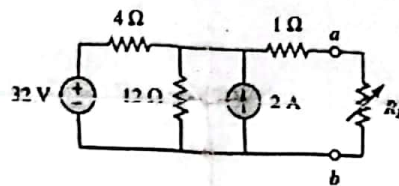


Fig 3(b)

4. a) Convert the following circuit to Norton's equivalent circuit. 2



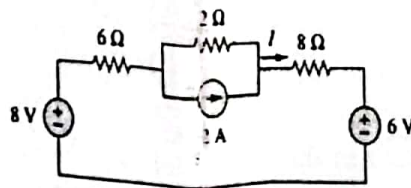
- b) Find the Thevenin equivalent circuit from the circuit below. Also Find the value of R_L for maximum power transfer in the circuit. 4+2



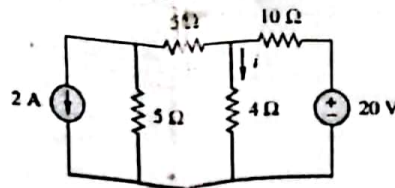
- c) Find the maximum power transferred to the load R_L . 2

5. a) State Superposition and Norton's theorem. 2+2

- b) For the circuit below, use the superposition theorem to find I . 3



- c) For this circuit, use source transformation to find i . 3



Metropolitan University, Sylhet
 Department of Computer Science and Engineering
 Summer Term Final Examination - 2022
 Program: B.Sc. in CSE; Batch: 57
 Course: MAT-112:: Differential and Integral Calculus

Time: 2 Hours

Marks: 40

Answer any four questions. All parts of each question must be answered sequentially. Figures in the right margin indicate full marks.

Group A

(Answer any two questions)

1. (a) If

$$\begin{aligned} f(x) &= x^2 & \text{when } x \leq 1 \\ &= x & \text{,, } 1 < x \leq 2 \\ &= \frac{1}{4}x^3 & \text{,, } x > 2 \end{aligned}$$

5

Examine the Continuity of $f(x)$ at $x = 2$.

(b) If

$$\begin{aligned} f(x) &= x & \text{when } 0 \leq x < \frac{1}{2} \\ &= 1 - x & \text{,, } \frac{1}{2} \leq x < 1 \end{aligned}$$

5

Examine the Differentiability of $f(x)$ at $x = \frac{1}{2}$

2. (a) State and prove Euler's theorem on homogeneous function of two variables.

6

(b)

If $u = \sqrt{x^2 + y^2 + z^2}$, Prove that $u_{xx} + u_{yy} + u_{zz} = \frac{2}{u}$

4

3. (a) Verify the application of Rolle's theorem for the function $f(x) = x^2$ in the interval $(-1, 1)$.

5

(b) Examine the validity of Mean Value theorem for the function $f(x) = x - x^3$ in the interval $(-2, 1)$.

5

Group B

(Answer any two questions)

4. Integrate any two of the followings:

(i) $\int \frac{1}{\sqrt{x^2 - 7x + 12}} dx$ (ii) $\int \frac{2x+7}{2x^2 - 2x + 1} dx$ (iii) $\int \frac{1}{5 + 4 \cos x} dx$

10

5. Show that (i) $\int_0^{\frac{\pi}{2}} \frac{1}{1 + \tan \theta} d\theta = \frac{\pi}{4}$ (ii) Prove that $\int_0^{\frac{\pi}{4}} \log(1 + \tan \theta) d\theta = \frac{\pi}{8} \log 2$

10

6. (a)

Define Beta Function and Gamma Function. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

6

(b)

Evaluate $\int_0^{\frac{\pi}{2}} \sin^3 x \cos^6 x dx$

4

Metropolitan University, Sylhet
Department of Computer Science and Engineering
Summer Semester Final Examination-2022
Program: B.Sc. in CSE; Batch: 57th (A,B,C,D,F)
Course: Eng-114: English Language-I

Time: 2 Hours

Marks: 40

(Figures on the right margin indicate full marks.)

❖ Read the following passage and answer questions 1 and 2:

"I Have a Dream" is a public speech delivered by American civil rights activist Martin Luther King Jr. during the March on Washington for Jobs and Freedom on August 28, 1963, in which he calls for an end to racism in the United States and called for civil and economic rights. Delivered to over 250,000 civil rights supporters from the steps of the Lincoln Memorial in Washington, D.C., the speech was a defining moment of the civil rights movement. Beginning with a reference to the Emancipation Proclamation, which freed millions of slaves in 1863, King observes that: "one hundred years later, the Negro still is not free".

Toward the end of the speech, King departed from his prepared text for a partly improvised peroration on the theme "I have a dream", prompted by Mahalia Jackson's cry: "Tell them about the dream, Martin!" In this part of the speech, which most excited the listeners and has now become its most famous, King described his dreams of freedom and equality arising from a land of slavery and hatred. Jon Meacham writes that, "With a single phrase, Martin Luther King Jr. joined Jefferson and Lincoln in the ranks of men who've shaped modern America". The speech was ranked the top American speech of the 20th century in a 1999 poll of scholars of public address.

1. Answer the following questions.

1×5=5

- a. What issues does Martin Luther King's speech address?
- b. What pushes King to speak: "I have a dream"?
- c. What is the name of Martin Luther King's famed speech?
- d. In front of whom does King speak?
- e. What kind of speech is "I have a dream"?

2. Summarize the above passage in your own words.

5

3. Re-write the following sentences with the correct form of verbs as per subject and context.

0.5×10=5

- | | |
|---|--|
| a. Sixty miles (be) a long distance. | h. A wearer knows where the shoe (pinch). |
| b. I am the man who (help) you. | i. High levels of pollution (cause) damage to the respiratory tract. |
| c. As soon as I came here, he (greet) me. | j. The chairman and chief patron (be) present. |
| d. He (refrain) from taking any drastic action. | |
| e. Yesterday, he (go) home. | |
| f. If Joe (be) here, you'd be sorry. | |
| g. I had him (wash) the dishes. | |

4. Change the following sentences into active/passive voice..

1×5=5

- a. Please let him eat a mango.
- b. Do you know him?
- c. The boys like the captain to call the manager.
- d. My teacher embodies all the good qualities.
- e. He was murdered at midnight.

5. State whether the underlined -ing forms given in the sentences are participle or gerund. In the case of participle, name the noun or pronoun they qualify. In the case of gerunds, state what function they serve in the sentence:

1×6=6

- a. He ruined his sight by watching TV all day.
- b. We saw a clown standing on his head.
- c. Asking question is a whole lot easier than answering them.
- d. My hobby is gardening.
- e. It is freezing cold.
- f. A barking dog seldom bites.

6. Suppose, you have came across with an advertisement on bdjobs.com that Metropolitan University, a reputed institution, is going to recruit an Admission Officer. Now, write an application to the Registrar for the job.

8

7. Write a paragraph on any ONE of the following topics in at least 200 words:

- a. E-learning
- b. Discipline in the Classroom

6

Metropolitan University, Sylhet

Department of Computer Science and Engineering

Summer Term Final Examination – 2022

Program: B.Sc. in CSE; Batch: 57

Course: CSE 121: Structured Programming

Time: 2 Hours

Marks: 40

Answer any four questions. All parts of each question must be answered sequentially. Figures in the right margin indicate full marks.

1. a) Consider the variable declaration: `double num[10];` 5
 - i. How many elements does the array have?
 - ii. What kind of value can be stored in each element?
 - iii. Which of the following is a correct usage of `scanf()` with this array?
`scanf("%ld", num[2]);` `scanf("%lf", &num[2]);` `scanf("%lf," &num);`
 - iv. Assign value 4.5 to the array index 3.
 - v. Call a function named "myArr" which passes the array to the function.
- b) Write the difference between while loop and do while loop with appropriate examples. 5
2. a) Write whether the statements below are true or false, and if false, write the correct answer. 5
 - i) `!` is a Bitwise Operator
 - ii) `&&` is a Relational Operator
 - iii) `strcmp("abc", "ABC")` will return 1
 - iv) `float numbers[];` is an invalid way to declare an array
 - v) `strcat(s1,s2)` will copy string s2 to string s1.
- b) Write a function that takes 3 integers as arguments and return the maximum among them. 5
3. a) Differentiate between pass by value and pass by reference. Describe with a proper example. 5
- b) Write a program that generates the first 20 Fibonacci numbers. 5

- ✓ 4. a) Write a program that takes the last 3 digits of your ID and prints whether it is odd or even. 5
- b) Write a program that takes a number and prints whether the number is palindrome or not 5

- ✓ 5. a) Write a program to calculate the cumulative sum of N integers. You will be given N and in the next line, there will be N numbers. You have to print cumulative sums from 1st to nth number. 10

For example:

Input	Output
12 0 8 7 6 1 2 4 -3 -1 11 0 5	0 8 15 21 22 24 28 25 24 35 35 40

- ✓ 6. a) Write a code for printing the following shape. 5

**

*

//Here n=5. But you must take input(n) from-keyboard.

- b) What will be the output of the following program? 5

```
#include<stdio.h>
int main(){
    int a[10]={8,5,6,0,4,2,3,7,1,9};
    for(int i=0;i<10;i++){
        if(a[i]%2==1){
            a[i]++;
            a[i]=a[i]*i;
            printf("%d %d \n",i,a[i]);
        }
    }
}
```

Metropolitan University
Department of Computer Science & Engineering
Program: B.Sc. (Engg.) in CSE Batch: 57
Course: PHY 111, Physics I
SET Alpha

Attempt any 4 (four) of the following questions. Write the "question set" in the top-right corner of the answer script.

Marks: 40

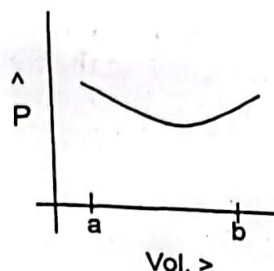
Time: 2 hours

- ✓ 1 (a) Draw two sin graphs of the same frequencies but the second wave has an amplitude twice the first wave. Draw them from the same starting point. 3
 - (b) When a sinusoidal wave travels along a string the time for a particular point to move from maximum displacement to zero displacement is 180 ms. If the wavelength of the wave is 90 cm find (a) the time period, (b) the frequency, and (c) the speed of the wave. 4
 - (c) Write an expression describing a transverse wave traveling along a string in the -ve x direction with wavelength 12 cm, frequency 360 Hz, and amplitude 36 cm. 3
 2. (a) State and Explain the 1st law of thermodynamics. 2
 - (b) Two identical rectangular rods of metal are welded end to end as shown in the figure above and 20 J of heat flows through the rods in 100 seconds. How long would it take for 40 J to flow through the rods if they are welded on top of one another? 3
-
- (c) Consider the case where a metal slab has infinitesimal thickness dx and temperature difference dT between its face and A being the cross-sectional area, then the rate of heat transfer, $H = kA \cdot dT/dx$. Find the unit of thermal conductivity k in the SI system. What do you mean by the value of $k = 10$? 2+1
 - (d) State three differences between heat and energy. 2
 - ✓ 3 (a) What is thermal equilibrium? Can one object be hotter than another if they are at the same temperature? **Explain.** 1+2
 - (b) What is radiation? Why convection is important for life on earth? 1+3
 - (c) If 2260 kJ heat is required to produce 1.7-liter steam from 1 liter of water, calculate the work done and change in internal energy in this process. (Pressure = 1×10^5 Pa) 3
 - ✓ 4 (a) What is the work done by a gas? When it is positive and when it is negative? 2+1

- (b) The first law of thermodynamics can be written as $Q + W = \Delta E_{\text{int}}$ where the symbols have the usual meaning. During a thermodynamic process, the first law becomes, $Q + W = 0$
Identify the process and give logic in support of your answer. 2

- (c) 100-liter water can produce as much as 1700 liters of steam when heated at STP. Find the amount of heat needed to produce that much steam and the work done in this process. (Pressure = 1×10^5 Pa) 3

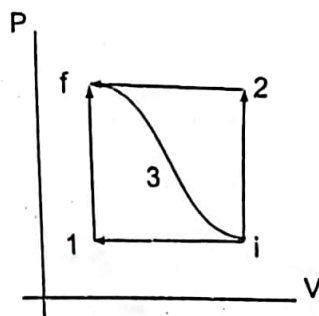
- (d) What would be the work done by gas between points a and b in the figure? Show by drawing on figure. 2



- ✓ (a) Define specific heat. Find an expression for the specific heat of a gas at constant volume. 1+2

- (b) A 10-g cube of aluminum originally at 200°C is placed into an insulated container of water originally at 38°C . After the system reaches equilibrium the final temperature of the water becomes 52°C . What is the final temperature of the aluminum cube? (A) It is greater than 52°C . (B) It is equal to 52°C . (C) It is less than 52°C . Justify your choice. 1+1

- (c) A sample of gas consisting of 2 mol is compressed from a volume of 4.0 m^3 to 1.0 m^3 while its pressure increases from 10 to 40 Pa. Compare the work done along paths 1 and 2. 3



- (d) For the figure above identify the types of thermodynamic processes involved along the three paths and indicate them. 2

6. (a) Define the reversible process and give an example. What is the change in entropy in this process? 2

- (b) Find the efficiency of a Carnot Engine. 3

- (c) If the Entropy of an ideal gas increases by 23 J/K when the gas undergoes a reversible isothermal expansion at 23°C . Find the amount of heat absorbed. 2

Find (a) the heat absorbed and (b) the change in entropy of a 10 gm copper whose temperature is increased reversibly from 25° to 105°C (specific heat of copper is 0.4 J/g K). 3

Metropolitan University, Sylhet
 Department of Computer Science and Engineering
 Summer Term Final Examination - 2022
 Program: B.Sc. in CSE (1st Year 1st Term); Batch: 57(A-F)
 Course: CSE 125: Discrete Mathematics

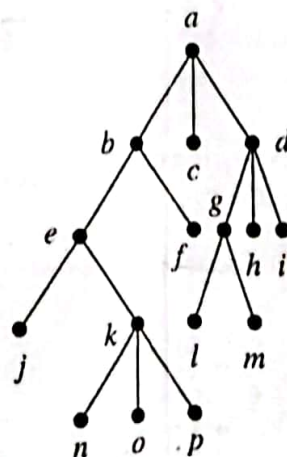
Time: 2 Hours

Marks: 40

Answer four questions, two from Group A and two from Group B. All parts of each question must be answered sequentially. Figures in the right margin indicate full marks.

Group A

1. (a) Show that the sequence $\{a_n\}$ is a solution of the recurrence relation
 $a_n = 3a_{n-1} + 4a_{n-2}$ if $a_n = 2(-4)^n + 3$ (3)
- (b) Find the first five terms of the sequence defined by each of these recurrence relations and initial conditions.
 $a_n = na_{n-1} + a_{n-2}^2, a_0 = -1, a_1 = 0$ (3)
- (c) Find $(f \circ g)(x)$ and $(g \circ f)(x)$, where $f(x) = x^2 + 1$ and $g(x) = x + 2$, are functions from \mathbb{R} to \mathbb{R} . (2)
- (d) Find these values. i) $\lfloor \frac{3}{2} \rfloor \cdot \lceil \frac{5}{3} \rceil$ ii) $\lceil \lceil 3 \rceil + \lfloor \frac{7}{5} \rfloor + \lceil \frac{5}{4} \rceil \rceil$ (2)
2. (a) What are the quotient and remainder when
 i) 0 is divided by 19?
 ii) -2002 is divided by 87? (2)
- (b) Find the values of integer a such that $a \equiv -20 \pmod{27}$ and $-26 \leq a \leq 26$. (3)
- (c) i) Find the prime factorization of $10!$. (2+3)
 ii) Use the Euclidean algorithm to find $\gcd(1529, 14038)$.
3. (a) Consider the following tree. (5)



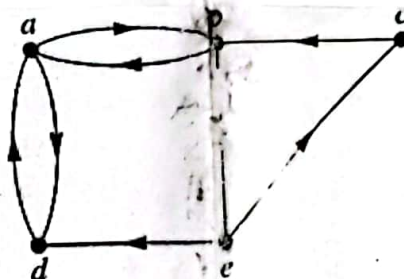
- i) What is the height of this tree? Which vertices are leaves?
- ii) Which vertices are children and siblings of g ?
- iii) Which vertices are ancestors of o and descendants of d ?
- iv) Find the level of each vertex in the rooted tree.
- v) What is the subtree rooted at e ?

- (b) Check if the graph G is bipartite by finding the chromatic number. (5)

$G = (V, E)$ where $V = \{a, b, c, d, e, f, g, h\}$ and
 $E = \{\{a, b\}, \{a, d\}, \{b, c\}, \{b, e\}, \{c, f\}, \{c, h\}, \{d, e\}, \{d, g\}, \{e, h\}, \{f, g\}\}$

Group B

4. (a) What is affine and monoalphabetic cipher? (2)
 (b) Encrypt the plaintext message "EXPERIENCE IS A GREAT TEACHER" using the shift cipher with shift $k = 7$. (2)
 (c) Decrypt the ciphertext message "DEZA RWZMLW HLCXTYR" that was encrypted with the shift cipher with shift $k = 11$. (2)
 (d) For transposition cipher, consider the following key: (4)
 Plaintext : 3 1 4 2
 Ciphertext: 1 2 3 4
 Encrypt the message "FIFA World Cup".
 Decrypt the message "WBAEOR FER MTA NISA".
5. (a) Find the articulation point and the cut edge of each graph. (4)
 i) W_4 ii) $K_{2,3}$
 (b) Consider the following graph. (6)



Does each of these lists of vertices form a path in the following graph? Which paths are simple? Which are circuits? What are the lengths of those that are paths?

- i) a, e, b, c, b ii) a, e, a, d, b, c, a
 iii) e, b, a, d, b, e iv) c, b, d, a, e, c

6. Consider the letters in the given sequence: V, X, K, Z, L, T, G, W, I, S, M, B, Y, Q, D, E. (4)
 (a) Make a Binary Search Tree. (6)
 (b) Traverse the tree in Preorder, Inorder and Postorder.