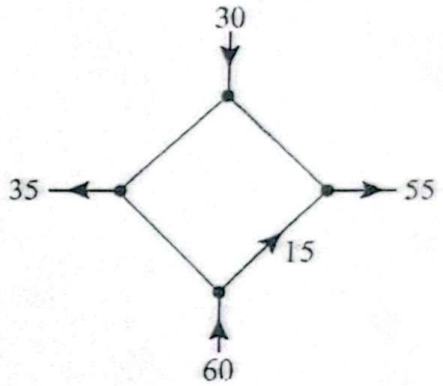
Course Title : Vector Calculus, Linear Algebra & Complex Variables

CT No.: 03 Course Code: MATH 243 Full Marks: 20 Time: 20 minutes

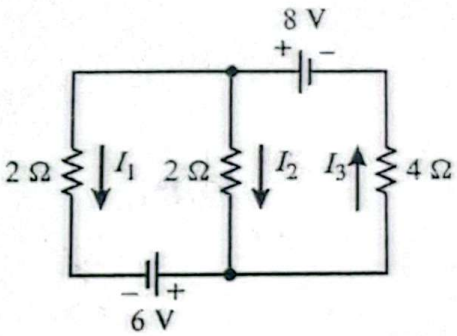
Answer all of the questions. Marks of each question are indicated at the right margin.

Marks

1. Attached figure demonstrates a network with four nodes in which the flow rate and direction of flow in certain branches are known. Form a system of linear equation to find the flow rate. [6]



2. Analyze the given electrical circuit in the attached figure by finding the unknown currents. [14]



— Have a Good Exam —

Course Title : Vector Calculus, Linear Algebra & Complex Variables

CT No.: 02 Course Code: MATH 243 Full Marks: 20 Time: 20 minutes

Answer all of the questions. Marks of each question are indicated at the right margin. Marks

1. Write down two differences between real and matrix arithmetic. [4]

2. Set an example of a matrix with order 5×5 that is skew-symmetric. [4]

3. Give a short answer to each of the following questions.

   (a) If A is an orthogonal matrix, then what does equal to A^{-1}? [2]

   (b) Suppose that A is an involutory matrix. Then what does equal to A^n when $n \in \mathbb{N}$? [4]

   (c) If $A_1, A_2, A_3, \cdots, A_n$ are matrices of suitable order, then what does equal to $(A_1 A_2 A_3 \ldots A_n)^T$? [2]

4. On your answer sheet, write **T** if the statement is true and write **F** otherwise. [4]

   (a) The value of a square matrix is called its determinant.

   (b) Two linear systems are equivalent, if they have same variables.

   (c) If A, B are two 2×2 matrices and A has a column of 0 (zero), then so does AB.

   (d) A system consisting of one linear equation in n variables has $n - 1$ free variables.

— Have a Good Exam —

CT-2 (CSE-223)

7. A linear time-invariant system characterized by its impulse response 07

$$h(n) = (1/3)^n\, u(n)$$

Determine the spectrum and the energy density spectrum of the output signal when the system is excited by the signal

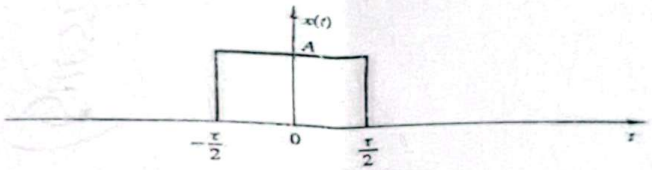
$$x(n) = (1/4)^n u(n)$$

8. Determine the inverse system of the system with impulse response 07

$$h(n) = (1/2)^n\, u(n)$$

9. Determine the Fourier transform and the energy density spectrum of the rectangular pulse train signal defined as 06

$$x(t) = \{A, \quad \text{if} : |t| <= \tau/2 \text{ else: } 0, \ |t| > \tau/2$$



CSE-223
Class Test -2 (21-Batch)

Total Time: 20 Minutes

Total Marks: 20

Q.1. Compute (graphically) the convolution sum $y(n)$ of the following signals: 10

$x(n) = \{\ldots\ 0, 1, 2, -1, 0\ \ldots\}$, and $h(n) = \{\ldots\ 0, 2, 3, 1, 0, \ldots\}$.

Q.2. Prove that - "Any arbitrary signal can be expressed as the sum of two signal components, one of which is even and the other odd". 06

Q.3. Distinguish between Linear and Nonlinear systems. 04

CSE-223

Class Test -1 (21-Batch)

Total Time: 20 Minutes

Total Marks: 20

Q.1. What are the advantages of digital signal processing over analog signal processing? 05

Q.2. Write down the characterizing properties of Discrete-Time Sinusoidal Signals. 06

Q.3. Draw the following discrete tine sinusoidal signal 09

$$x(n) = 2\sin(2\pi fn + \theta)$$

Consider that $N = 8$ and $\vartheta = \pi/4$

EE 283 CT-1 21batch 20minutes

1. How AC can be converted to pulsating DC in a simple loop DC generator? 11
2. Describe the functions of Armature, Armature winding and Commutator in a practical DC generator? 09

CT-1

Course Code: CSE-243 Marks: 20

Q1. $T(n) = T(n/2)$ where $n>1$

$T(n)=1$ when $n=1$

Solve this recurrence relation using substitution method and recursive tree method.

CSE-243 (CT-4)

Time: 20 minutes

Marks: 20

1. Prove that any comparison sort algorithm requires $\Omega(n \lg n)$ comparisons in the worst case. 10
2. Write down the pseudo code for heap sort algorithm and calculate the time complexity. 10

CT-01 2104020

CSE-251	Full marks- 20	Time- 25 minutes

2. The database must store book, author, publisher and warehouse information. For every book you must capture the title, isbn, year and price information. For every author you must store an id, name, detailed address and more than one phone number. Each author can write many books, and each book can have many authors. For every publisher you must store an id, name, address, phone number and an URL of their website. Books are stored at several warehouses, each of which has a code, address and phone number. A book has only one publisher. The warehouse stocks many different books. A book may be stocked at multiple warehouses. The database records the number of copies of a book stocked at various warehouses.

(c) Design an ER diagram for such a bookstore. Your ER diagram must show entities, attributes and the relationships between entities. (12)

(d) Derive relational mapping for the ER Diagram drawn for (a). (08)

Tabassum Erin

2104020

C.T. – 02 **CSE-251 Data Base Management Systems** **Marks – 20**

1. What is a correlated subquery, and how is it different from a regular subquery? **05**

2. In July 2024, Bangladesh experienced a significant political upheaval known as the Student-People's Uprising. Consider a database of following schema – **15**

Protests → *ProtestID, Location, Date, Crowdsize, Reason*

Casualties → *CasualtyID, ProtestID, CasualtyType, Description*

Government Response → *ResponseID, ProtestID, CasualtyID, ActionTaken, Impact, Date of Response*

Write appropriate SQL expression for the following queries:

a. List all protests that occurred in Chattogram and had more than 500 participants
b. Find the total number of casualties for the protest held in Dhaka on July 15, 2024
c. Retrieve all government responses for protests that took place after July 2024
d. Retrieve the protests that had casualties of both "Injured" and "Killed" types
e. Find the number of government actions (e.g., curfew, shutdown) and casualties for protests in Dhaka and Chittagong

2104020

C.T. – 03 CSE-251 Data Base Management Systems Marks – 20

1. Consider a database of following schema –

User (userid, username, country)

Problem (problemid, title, difficulty_level, category)

Submissioin (submissionid, userid, problemid, submission_time, verdict)

Write relational algebra expression for the following queries:

a. List the titles of the tree problems that remains unsolved.
b. Find the names of users who have solved a problem with "Hard" difficulty level.
c. Find the Bangladeshi users that have solved a problem in year of 2025.
d. Find the difficulty level and category of problems for whose user "XYZ" has received TLE.

Id

CT-03 2104020

CSE-251	Full marks- 20	Time- 20 minutes

1. Indices speed query processing, but it is usually a bad idea to create indices on every attribute, and every combination of attributes, that are potential search keys. Explain why. (07)
2. Construct a B+-tree for the following set of key values of order 4: (13)

   (2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

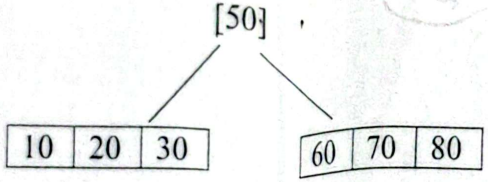
   (a) Insert the following keys into the B+ tree sequentially: 9, 10, 8, 14, 35

   (b) Delete the following keys sequentially from the resulting tree: 23, 19, 31, 7, 14

CT-03 2104020

CSE-251	Full marks- 20	Time- 25 minutes

1. What is the difference between a clustering index and a secondary index? Explain with example. (05)
2. You are given the following initial B+ tree of order 3. The tree initially looks like this: (15)



(a) Insert the following keys into the B+ tree sequentially: 25, 35, 40, 55
(b) Delete the following keys sequentially from the resulting tree: 30, 50, 70, 20
(c) Why is B+ tree preferred for database indexing over other tree based structures?