NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2023 - 2024)
Subject: Discrete Structures

Time: 3 Hours   Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*
*1. This Question paper comprises of **three Sections -A, B, & C.** It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A   20

1. Attempt all parts:-

1-a.   _____ is the multiplicative identity of natural numbers. (CO1)   1

    (a)   0

    (b)   -1

    (c)   1

    (d)   2

1-b.   If set A has 4 elements and B has 3 elements then set n(A X B) is : (CO1)   1

    (a)   12

    (b)   14

    (c)   27

    (d)   7

1-c.   The set of odd and even positive integers closed under multiplication is _____.   1
    (CO2)

    (a)   a free semigroup of $(M, \times)$

    (b)   a subsemigroup of $(M, \times)$

    (c)   a semigroup of $(M, \times)$

    (d)   a subgroup of $(M, \times)$

1-d.   Let '*' be a binary operation on N defined by $a*b=a-b+ab2$, then find $4*5$. (CO2)   1

    (a)   9

    (b)   88

    (c)   98

    (d)   99

1-e.   _____ are the is/are universal logic gates. (CO3)   1

    (a)   OR and NOR

    (b)   AND

    (c)   NAND and NOR

    (d)   NOT

1-f.   The number of literals in the expression F=X.Y' + Z are___(CO3)   1

    (a)   3

    (b)   2

    (c)   4

    (d)   1

1-g.   Let P: I am in Bangalore.; Q: I love cricket.; then $q \to p$ is : (CO4)   1

    (a)   If I love cricket then I am in Bangalore

    (b)   If I am in Bangalore then I love cricket

    (c)   I am not in Bangalore

    (d)   I love cricket

1-h.   The premises $(p \wedge q) \vee r$ and $r \to s$ imply which of the conclusion : (CO4)   1

    (a)   p v q

    (b)   p v s

    (c) $p \wedge q$

    (d)   q v r

1-i.   In a graph if E=(u,v) means (CO5)   1

    (a)   u is adjacent to v but v is not adjacent to u

    (b)   e begins at u and ends at v

    (c)   u is processor and v is the successor

    (d)   both b and c

1-j.   _____ is a discrete structure that represents hierarchical relationships between individual elements or nodes.(CO5)   1

    (a)   Tree

    (b)   Graph

    (c)   Root

    (d)   Vertices

2. Attempt all parts:-

2.a.   List three operations possible on relations.(CO1)   2

2.b.   Define rings and write it's properties. (CO2)   2

2.c.   Prove that complement of an element is unique.(CO3)   2

| 2.d. | Define Proposition with an example. (CO4) | 2 |
| 2.e. | Describe multigraph with example. (CO5) | 2 |

SECTION-B 30

3. Answer any <u>five</u> of the following:-

3-a.	If A = {1, 5, 8, 9) and B {2, 4} and f={(1, 2), (5, 4), (8, 2), (9, 4)}. Then prove f is a onto function.(CO1)	6
3-b.	Let A = {1, 2, 3, 4}, give an example of a mapping which is (i) neither symmetric nor anti-symmetric, (ii) anti-symmetric and reflexive but not transitive, (iii) transitive and reflexive but not anti-symmetric.(CO1)	6
3-c.	Let G,G′ be groups. Suppose that we have a surjective group homomorphism f:G→G′. Show that if G is an abelian group, then so is G′.(CO2)	6
3-d.	Prove that the additive group Q=(Q,+) of rational numbers is not finitely generated. (CO2)	6
3.e.	Is there finite set such that it is a poset and totally ordered set but not a well-ordered set. Justify. (CO3)	6
3.f.	Describe all Quantifiers and explain with examples. (CO4)	6
3.g.	Explain complete graph and regular graph with an example. (CO5)	6

SECTION-C 50

4. Answer any <u>one</u> of the following:-

| 4-a. | State differences between 'Difference of sets' and 'Symmetric difference of sets'. Also give their examples individually.(CO1) | 10 |
| 4-b. | Solve the recurrence relation 2ar-5ar-1+2ar-2 =0 then find the particular solution ao = 0 and a1 = 1. (CO1) | 10 |

5. Answer any <u>one</u> of the following:-

| 5-a. | Let Q=(Q,+) be the additive group of rational numbers. (a) Prove that every finitely generated subgroup of (Q,+) is cyclic. (b) Prove that Q and Q×Q are not isomorphic as groups.(CO2) | 10 |
| 5-b. | Prove Lagrange's theorem. (CO2) | 10 |

6. Answer any <u>one</u> of the following:-

| 6-a. | Describe properties of lattices. (CO3) | 10 |
| 6-b. | Describe distributive lattice in detail with an example. (CO3) | 10 |

7. Answer any <u>one</u> of the following:-

| 7-a. | Draw the truth tables of AND, OR, NOT, NAND,NOR,XOR,XNOR gates. Mention which of them are universal gates. (CO4) | 10 |
| 7-b. | Explain Tautology and Contradiction with definition and examples. (CO4) | 10 |

8. Answer any <u>one</u> of the following:-

| 8-a. | Differentiate between Euler and Hamiltonian paths. Explain with the help of diagrams. (CO5) | 10 |

8-b.   Find a unique tree when these two traversals are given. Using the INORDER: H K   10
         D B I L E A F C M J G
         PREORDER: A B D H K E I L C F G J M. (CO5)

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