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Subject Code:- **AMICSE0306**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech(Integrated)

SEM: III - THEORY EXAMINATION (2022 - 2023)

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. The complement of the set A is ______________ (CO1) 1

(a) A – B

(b) U – A

(c) A – U

(d) B – A

1-b. Determine the number of ways of choosing a cricket team (consists of 11 players) out of 18 players if a particular player is never chosen. (CO1) 1

(a) 12798

(b) 22800

(c) 31824

(d) 43290

1-c. ___________ matrices do not have multiplicative inverses. (CO2) 1

(a) non-singular

(b) singular

(c) triangular

(d) inverse

1-d. Lagrange’s theorem specifies ___________. (CO2) 1

(a) the order of group is finite

(b) the order of the semigroup is added to the order of the group

(c) the order of the subgroup divides the order of the finite group

(d) the order of cyclic group is infinite

1-e. In which of the following relations every pair of elements is comparable. (CO3) 1

(a) ≤

(b) !=

(c) >=

(d) ==

1-f. A _________ has a greatest element and a least element which satisfy 0<=a<=1 for every a in the lattice(say, L). (CO3) 1

(a) semilattice

(b) join semilattice

(c) bounded lattice

(d) meet semilattice

1-g. Let P: We should be honest., Q: We should be dedicated., R: We should be overconfident. Then ‘We should be honest or dedicated but not overconfident.’ is best represented by. (CO4) 1

(a) ~P V ~Q V R

(b) P ∧ ~Q ∧R

(c) P V Q ∧ R

(d) P V Q ∧ ~R

1-h. The number of logical connectives are …..... (CO4) 1

(a) 2

(b) 3

(c) 4

(d) 5

1-i. A graph which consists of disjoint union of trees is called (CO5) 1

(a) bipartite graph

(b) forest

(c) caterpillar tree

(d) labeled tree

1-j. A graph containing self loop and parallel edges are called (CO5) 1

(a) Simple graph

(b) Multigraph

(c) Regular graph

(d) Path

2. Attempt all parts:-

2.a. Define: (i) Equal set (ii) Subset (CO1) 2

2.b. Show that (R – {1}, *) where the operation is defined as a*b = a +b –ab is an abelian group. (CO2) 2

2.c. Define totally ordered set with an example. (CO3) 2

2.d. Write rules of inference for i) Modus tollens ii) Disjunctive syllogism (CO4) 2

2.e. Explain bipartite and complete bipartite graph with suitable example. (CO5) 2

SECTION B 30

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

3-a. Differentiate linear homogeneous recurrences with linear non- homogeneous recurrence relations. (CO1) 6

3-b. Determine whether each of these functions is a bijection from R to R. 6

a) f(x) = 2x + 1

b) f(x) = x2 + 1 (CO1)

3-c. Show that the set of all positive rational numbers forms an abelian group under the composition * defined by a * b = (ab)/2. (CO2) 6

3-d. State and prove Lagrange’s Theorem. (CO2) 6

3.e. Is the “divides” relation on the set of positive integers transitive? What is the reflexive and symmetric closure of the relation? R = {(a, b) | a > b} on the set of positive integers? (CO3) 6

3.f. Let S(x) be the predicate “x is a student,” F (x) the predicate “x is a faculty member,” and A(x, y) the predicate “x has asked y a question,” where the domain consists of all people associated with your school. Use quantifiers to express each of these statements. 6

a) Lois has asked Professor Michaels a question.

b) Every student has asked Professor Gross a question.

c) Every faculty member has either asked Professor

Miller a question or been asked a question by Professor Miller.

d) Some student has not asked any faculty member a question. (CO4)

3.g.	Discussan example of preorder, postorder & inorder traversal of a binary tree of your choice with at least 12 vertices. (CO5)	6

SECTION C — 50

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

4-a.	Define principle of duality wit example. Represent atleast 5 operations possible on Sets using Venn Diagram with suitable example. (CO1)	10
4-b.	What is composition of function. State difference between 'f o g' and 'g o f' with example. (CO1)	10

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

5-a.	Explain cyclic group and prove that every cyclic group is abelian group but every abelian group is not cyclic group. (CO2)	10
5-b.	State about: (a) order of an element of a group with example. (b) Generating element in a cyclic group with example. (c) Abelian group. (CO2)	10

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

6-a.	Concern the following poset ({1},{2},{4},{1,2}{1,4}{2,4},{3,4}{1,3,4},{2,3,4}, ⊆), *(1) find the maximal element(2). Find the minimal elements. (3). Find all the upper bound of ({2},{4}) and the least upper bound if it exist. (CO3)*	10
6-b.	Explain different types of lattice. Show that Lattice is modular , distributive but not complemented with example. (CO3)	10

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

7-a.	Let P (x) be the statement "x spends more than five hours every weekday in class," where the domain for x consists of all students. Express each of these quantifications in English. (CO4)	10

a) $\exists x P(x)$,

b) $\forall x P(x)$,

c) $\exists x \neg P(x)$,

d) $\forall x \neg P(x)$.

7-b.	Show that each of these conditional statements is a tautology by using truth tables. (CO4) a) $(p \wedge q) \rightarrow p$, b) $p \rightarrow (p \vee q)$, c) $\neg p \rightarrow (p \rightarrow q)$, d) $(p \wedge q) \rightarrow (p \rightarrow q)$, e) $\neg(p \rightarrow q) \rightarrow p$ f) $\neg(p \rightarrow q) \rightarrow \neg q$	10

8. Answer any one of the following:-

8-a.	Show that there does not exist a graph with 5 vertices with degrees 1, 3, 4, 2, 3 respectively. Also explain Define Graph coloring. What is its application? (CO5)	10
8-b.	(a) Suppose a graph G contains two disctinct paths from vertex u to a vertex v. Show that G has a cycle. (b) Find the number of connected graph with 4 vertices. Also draw the graph. (CO5)	10