4E1301

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# 4E1301

## B. Tech. IV - Sem. (Main / Back) Exam., - 2025
## Computer Sc. & Engineering (Cyber Security)
## 4CCS2-01 Discrete Mathematics Structure
## CS, IT, AID, CAI, CCS, CDS, CIT

**Time: 3 Hours** **Maximum Marks: 70**

*Instructions to Candidates:*

***Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL 2. NIL

## PART – A

[10×2=20]

**(Answer should be given up to 25 words only)**

**All questions are compulsory**

Q.1 If A = {1, 2, 3} and B = {a, b, c}, how many total possible relations can be formed from A to B?

Q.2 If f, g : $\mathbb{R} \rightarrow \mathbb{R}$ are defined as $f(x) = x^2$ and $g(x)$ $5x + 1$. Find the composition $(f \circ g)(x)$ at $x = 2$.

Q.3 When are two finite state automata said to be equivalent?

Q.4 Define universal and existential quantifiers.

Q.5 What is a complemented lattice?

Q.6 Find the middle term in the expansion of $(x^2 + 2/x^4)^{14}$.

Q.7 What is an Abelian Group? Give an example of an infinite Abelian group.

Q.8 Define the cyclic group.

Q.9 What do you mean by a regular graph?

Q.10 Draw graph which is -

(a) Eulerian but not Hamiltonian.

(b) Hamiltonian but not Eulerian.

## PART – B

[5×4=20]

**(Analytical/ Problem solving questions)**

**Attempt any five questions**

Q.1 Among 50 students in a class, 26 got an A in the first examination and 21 got an A in the second examination. If 17 students did not get an A in either examination, how many students got A in both the examinations?

Q.2 Use mathematical induction to prove that for all $n \geq 1$, $10^n - 1$ is divisible by 9.

Q.3 Prove by constructing truth table

$$P \rightarrow (Q \vee R) \cong (P \rightarrow Q) \vee (P \rightarrow R).$$

Q.4 Let B be the power set of S = {1, 2, 3} and (B, ≤) be a poset defined by $X \leq Y$ if $X \subseteq Y$ for $X, Y \in B$. Draw the Hasse diagram of the poset (B, ≤).

Q.5 How many words can be formed from the letter of the word "DAUGHTER" if the vowels always coming together?

Q.6 Prove that the intersection of any two normal subgroups of a group G is normal subgroup of G.

Q.7 Determine whether the graph given below by its adjacency matrix is connected or not.

$$\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix}$$

# PART – C

[3×10=30]

**(Descriptive/ Analytical/ Problem Solving/ Design Questions)**

**Attempt any three questions**

Q.1 Let R be a relation defined on the set $\mathbb{N} = \{1, 2, 3 \ldots\ldots\}$ such that $a, b \in \mathbb{N}$, aRb if and only if $a = b^k$, $k \in (0, 1, 2, 3, \ldots\ldots)$. Then show that R is a partial ordering relation on $\mathbb{N}$.

Q.2 (a) Find the disjunctive normal form of

$$P \rightarrow ((P \rightarrow Q) \wedge \sim (\sim P \vee \sim P)).$$

(b) Show that the following proposition is tautology:

$$(P \rightarrow Q) \leftrightarrow (\sim P \vee Q)).$$

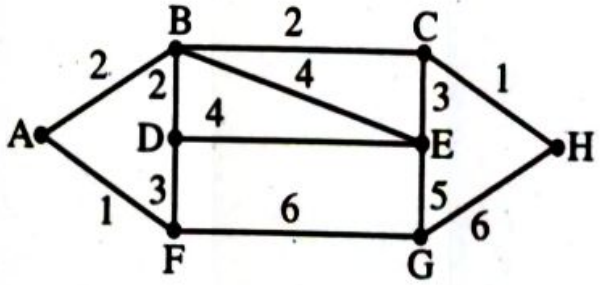
Q.3 Find an explicit formula for the following linear homogeneous recurrence relation :

$$a_n = -4a_{n-1} - 3a_{n-2}, \text{ if } n \geq 2,$$

with the initial conditions $a_0 = 4$ and $a_1 = 8$.

Q.4 Show that the set of all square matrix of order (m × m) under the binary operations addition and multiplication is a non-commutative ring.

Q.5 Using Dijkstra's algorithm, find the shortest path between the vertices A and H in the weighted graph shown in figure.

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