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AIML-I
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AL-401

# Introduction to Discrete Structures & Linear Algebra

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**New Scheme Based On AICTE Flexible Curricula**

**CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning**
**IV-Semester**

## AL401 Introduction to Discrete Structure &Linear Algebra

**Unit 1:** Set Theory, Relation, Function, Theorem Proving Techniques:Set theory: definition of sets, Venn Diagram, proofs of some general identities on set,Relation: Definition, Types of relation ,Composition of relation ,Equivalence relation, Partial ordering relation,POSET,Hasse diagram and Lattice .

**Unit 2:**Algebraic structure: Definition, Properties, types: Semi Group, Monoid, Groups, Abelian Group, Properties of group, cyclic group, Normal subgroup, Ring and Fields: definition and standard result, Introduction to Recurrence Relation and Generating Functions.

**Unit 3:**Propositional logic: Proposition, First order Logic, Basic logical operation, Truth tables, Tautologies and Contradiction, algebra of proposition, logical implication, logical equivalence ,predicates, Normal Forms, Quantifiers
Graph theory: Introduction and basic terminology of graph, types of graph, Path, Cycles, Shortest path in weighted graph, graph colorings.

**Unit 4:** Matrices: Determinant and Trace,Cholesky Decomposition, Eigen decomposition,Singular Value decomposition(SVD),Gradient of a matrix:Useful identities For computing Gradient.

**Unit 5:** Test of Hypothesis : Concept and Formulation ,Type-I and Type-II Errors,Time Series Analysis ,Analysis of Variance (ANOVA).

**References:**


1. C.L.Liu, "Elements of Discrete Mathematics" Tata Mc Graw-Hill Edition.
2. Trembley, J.P & Manohar; "Discrete Mathematical Structure with Application CS", McGraw Hill.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications", McGraw Hill.
4. Bisht, "Discrete Mathematics",Oxford University Press
5. Biswal,"Discrete Mathematics & Graph Theory", PHI
6. Mathematics For Machine Learning-Marc Peter Deisenroth,A. Aldo Faisal,Cheng soon ong
7.Statistical Method- S.P. Gupta

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Unit - 3

# Propositional Logic

No. 1

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## Proposition / Statement / Syntax

* A proposition or a statement is a declarative sentence which is either universally true or universally false but not both.
It is denoted by p, q, r ... etc.

* The value for proposition (T) is 1 and for (F) is 0.

## Logical Operators / Logical Connectives

| Connective English word | Name of Logical Connective | Symbol |
|---|---|---|
| Not | Negation | $\sim$ or $\neg$ |
| And | Conjunction | $\wedge$ |
| Or | Disjunction | $\vee$ |
| Implies or If... Then... | Conditional | $\rightarrow$ or $\Rightarrow$ |
| If & only If or double Implies | Bi-conditional | $\leftrightarrow$ or $\Leftrightarrow$ |

# Truth Tables

1) Negation :

| $p$ | $\sim p$ |
|---|---|
| T | F |
| F | T |

2) Conjunction :

Note : Number of cases $= 2^n$
where (n) is number of statements involved eg → Negation $= 2^1 = 2$
Conjunction $= 2^2 = 4$

| $p$ | $q$ | $p \wedge q$ |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |