

**Course Code:** MATH 212  
**Course Title:** Set Theory & Mathematical Logic  
**Credit Hours:** (3 0 3)  
**Pre-requisite(s):** None

**Course Objectives:**

The objectives of this course are:

- To learn about basic set operations and their properties.
- To learn how to formally construct and model mathematical objects on set-theoretical grounds.
- To learn how to correctly express thoughts and to correctly reason using logical tools

**Reading list:**

- C.C.Pinter, "Set theory", Dover Publication Inc Inc. N.Y, 2014.
- J.Nolt,D.Rohatyn,A.Varzi,"Logic",2nd Edition, Mc Graw Hill, 2011
- P.R.Halmos, "Native Set Theory", Martino fine Books, 2011.
- S.Lipschutz, "Theory and problems of set theory and related topics", 2nd Edition, Mc Graw Hill, 1998.

**Lecture-wise distribution of the Contents**

Lecture #	Topic
L1-L2	Introduction to the course, Set and basic operations on sets , Intervals ,Bounded sets, completion properties
L3-L5	Relations, Pictorial representation of relations, composition of relations, Types of relations, Partitions, Equivalence relations.
L6-L8	Partial ordering relations, Functions, composition of functions ,invertible functions ,Recursively defined functions
L9-L11	Operations on collection of sets, indexed collection of sets, Fundamental products, Associated set functions, Choice functions.
L12-L13	Algorithms and functions, complexity of algorithms
L14-L16	Equipotent sets, Denumerable and countable sets, Real numbers and the power of continuum.
L17-L18	Cardinal numbers, Ordering of cardinal numbers, Cardinal arithmetic
L19-L21	Ordered sets, partially ordered set and hasse diagrams, minimal and maximal elements.
L22-L23	First and last elements, Supremum and infimum, Isomorphic ordered sets
L24	<b>MID EXAM</b>
L25-L28	Order types of linearly ordered sets, Lattices, Bounded, distributive and complemented lattices
L29-L31	Well ordered sets, similarity between well ordered set and its subset, ordinal numbers, Structure of ordinal numbers.
L32-L33	Auxiliary construction of ordinal numbers, Axiom of choice
L34-L36	Well ordering theorem, Zorn's lemma
L37-L39	Propositions and compound Propositions, Basics logical operations, tautologies and contradictions, logical equivalence

L40-L42	Conditional and bi-conditional statements, Arguments, logical Implications
L43-L45	Quantifiers, Boolean Algebra, Isomorphic Boolean Algebra
L46-L48	Duality, Boolean Algebra as lattices