**MA-104** Elements of Set Theory and Mathematical Logic

**Credit Hours: 3**

**Prerequisites:** Knowledge of Intermediate Mathematics

Specific Objectives of course: Everything mathematicians do can be reduced to statements about sets, equality and membership which are basics of set theory. This course introduces these basic concepts. The course aims at familiarizing the students with cardinals, relations and fundamentals of propositional and predicate logics.

**Course Outline:**

**Set theory:** Sets, subsets, operations with sets: union, intersection, difference, symmetric difference, Cartesian product and disjoint union. Functions: graph of a function. Composition; injections, surjections, bijections, inverse function. Computing cardinals: Cardinality of Cartesian product, union. Cardinality of all functions from a set to another set. Cardinality of all injective, surjective and bijective functions from a set to another set.

Infinite sets, finite sets. Countable sets, properties, examples (Z, Q). R is not countable. R, RxR, RxRxR have the same cardinal. Operations with cardinal

numbers. Cantor-Bernstein theorem.

Relations: Equivalence relations, partitions, quotient set; examples, parallelism, similarity of triangles. Order relations, min, max, inf, sup; linear order. Examples: N, Z, R. Well ordered sets and induction. Inductively ordered sets and Zorn’s lemma.

**Mathematical logic:**

Propositional Calculus. Truth tables. Predicate Calculus.

**Recommended Books:**

1. M. Liebeck, A Concise Introduction to Pure Mathematics, CRC Press,

2011.

1. N. L. Biggs, Discrete Mathematics, Oxford University Press, 2002.
2. R. Garnier, J. Taylor, Discrete Mathematics, Chapters 1,3,4,5, CRC

Press, 2010.

1. A.A. Fraenkal, Abstract Set Theory, North-Holland Publishing Company, 1966.
2. P. Suppes, Axiomatic Set Theory, Dover Publication, 1972.
3. P.R. Halmos, Naive Set Theory, New York, Van Nostrand, 1950.
4. B. Rotman, G.T. Kneebone, The Theory of sets and Transfinite Numbers, Oldbourne London, 1968.
5. D. Smith, M. Eggen, R.St. Andre, A Transition to Advanced Mathematics, Cole, 2001.