

# Department of Mathematics

## Mathematical Logic, 2022-23

### Syllabus

- Weekly hours:
  1. Lesson: 2 weekly hours
  2. Exercise: 1 weekly hour
  3. Lab: 0 weekly hours
- Credits: 2.5

#### **Course Objectives:**

The course will provide an introduction to mathematical formalization, deduction, formal proof, and in general basic ideas and concepts of mathematical logic which students will encounter in their subsequent studies in computer science. The course will provide an introduction to elementary graph theory.

#### **Course Plan:**

##### **Sentential Logic**

- Connectives, sentences, truth tables, formalization, formal definition of syntax of sentential logic, semantics of sentential logic, satisfiability.
- Recursive definition, structural induction.
- Disjunctive and conjunctive normal forms (DNF, CNF).
- Complete set of connectives.
- Tautology, contradiction, logical implication, equivalence of sentences.

- Deductive system, sound rules of inference, formal deduction, completeness and soundness of a deductive system, proof by contradiction, inconsistent set of sentences.

### **Predicate Logic**

- Definitions, quantifiers, bound and free variables, wff and sentence, interpretation.
- Deductive systems and rules of inference.
- Godel's completeness theorem.
- Prenex normal forms.

### **Introduction to graph theory**

- Directed and undirected graph, definitions, isomorphic graphs.
- Definitions and theorems: empty graph, complete graph, regular graph, bipartite graph, cube graph, tree, planar graph, Euler path and cycle, Hamiltonian path and cycle.

### **Evaluation:**

- Exam - 90%
- Exercises - 10%

### **Bibliography:**

1. Discrete Mathematics, Vol. 3 - Mathematical Logic, S. Berger, A. Ginsberg, Open U press, 1990.
2. Logic for Computer Science, Yoram Hirshfeld, Open U press, 2015.
3. Discrete Mathematics, S. Dar and S. Gueron, 2nd Ed., 2000.
4. Discrete Mathematics, N. Linial and M. Parnas, 2001.