Course Name : Discrete Mathematics							
Course Code	**Course Type**	**Regular Semester**	**Lecture (hours/week)**	**Seminar (hours/week)**	**Lab. (hours/week)**	**Credits**	**ECTS**
CMP 130	B	Spring	3.00	1.00	0.00	3.50	5.00

Lecturer	Artur Koci, PhD
Assistant	Vladimir Muka, Msc
Course language	Albanian
Course level	Bachelor
Description	Learning any area of mathematics requires a comprehension of the concepts occurring in the area (each of which requires a clear definition) and a knowledge of certain valid statements, each of which is either an axiom (whose truth is accepted without proof) or a theorem (whose truth can be established with the aid of concepts and other statements). This is best accomplished if we can understand proofs of theorems and are able to write some proofs of our own. In course discrete mathematocs will be introduced to several methods of proof that can be used to establish the truth of theorems as well as ways to show that statements are false. These methods are based on logic, which allow us to use reasoning to show that a given statement is true or false. Although it is not our intention to go into any of this in great depth, it is our goal to present enough details and examples so that a sound introduction to proofs can be obtained. Developing a good understanding of proofs requires a great deal of practice and experience and comprehending how others prove theorems. The main areas of study are logic and proofs, predicates and Quantifiers theory, set theory, number theory, relations and functions, sequences, numerical series and induction
Objectives	The objective of the Discrete Mathematics course is to provide students broad and accessible guide to the fundamentals of discrete mathematics and to show how it may be applied to various areas, especially computer science and information technology. Through this course it is intended to learn students schemes and algorithms of mathematical logic in order to have them as effective tools for solving various problem situations. To achieve this goal, in the teaching materials of the discrete mathematics course, concepts related to mathematical logic, predicates and quantifier, mathematical theory of sets, mathematical reasoning, number theory, relations, functions, recurrences, algorithms, sequence, numerical series and mathematical induction.
Core Concepts	1. Sequences and sums (arithmetic progression, geometric progression). 2. Binomial coefficients and Pascal’s triangle. 3. Set Theory, sets, subsets, set operations, properties of operations. 4. The set of real numbers and complex numbers. 5. Propositional logic (Propositions, mohimi, conjunction, disjunction, conditional proposition, biconditional Propositions, tautologies, contradictions). 6. Predicates and quantifiers (universal quantitative statement, existential quantitative statement, negation of quantitative statements). 7. Proof methods (direct proof, proof by contrapositive, proof by contradiction, proof by cases, proof of existence, mathematical induction). 8.Teoria e numrave real (Euclidean Algorithm, divisibility, greatest common divisor, least common multiple, congruence, representation of numbers in different bases).

Course Outline

Week	Topic
1	Sequences and sums of arithmetic progression Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 3-22 Recommended literature Oscar Levin (2017) Discrete Mathematics/ Second Edition, faqe 11-16 Susanna S. Epp., (2020) Discrete mathematics with applications fifth edition, faqe 258-275 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof, faqe 149-154

2	Sequences and sums of geometric progression. Binomial coefficients and Pascal’s triangle Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 23-33 Recommended literature Kevin Ferland (2017).- Discrete Mathematics and Applications- Second Edition, faqe 227-238 Gary Chartrand, Albert D. Polimeni, Ping Zhang (2018)/ Mathematical Proofs, fourth edition page 354-371 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 290-338 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof/ seventh edition, page 250-260
3	Set definition. Subsets, Equality of sets. Power sets. The set of real numbers. The set of complex numbers. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 33-44 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 53-62 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 79-100 Susanna S. Epp., (2020) Discrete mathematics with applications fifth edition, page 377-410
4	The universal sets. Operations with sets and their properties (Intersections and Unions, Difference and Symmetric Difference, Complement of a Set).. Cartesian Products of Sets. Partitions. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 45-66 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 53-79 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 100-150 Oscar Levin (2017) Discrete Mathematics/ Second Edition, page 17-29 T Veerarajan (2019)/ Discrete mathematics, page 270-284
5	Statements. Truth Values. Truth Tables. Compound Statements. Negation, Conjunction and Disjunction. Implications. Converse of an Implication. Contrapositive of an Implication. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 67-80 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 7-40 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 1-26 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof/ seventh edition, page 1-30 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 14-31
6	Biconditionals. Tautologies and Contradictions. Logical laws. Logical Equivalence. Substitution laws in mathematical logic. Some Applications of Logic. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 81-96 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 41-53 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 27-49 T Veerarajan (2019)/ Discrete mathematics, page 5-28
7	Review
8	Midterm
9	Predicates, their transformation into statements. The truth set of a predicate. Negation, conjunction and disjunction of predicates. Logical laws of predicates. Predicative implication. Biconditionals predicative implication. Universal quantification. Its truth. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 97-115 Recommended literature Oscar Levin (2017) Discrete Mathematics/ Second Edition, page 1-17 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 36-57 Susanna S. Epp., (2020) Discrete mathematics with applications fifth edition, page 108-132
10	Existential quantification. Its truth. Negation of Universal quantification. Negation of Existential quantification. Morgan's Laws of Negation of Quantitative Statements. Quantitative statements with superimposed quantifiers. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 116-130 Recommended literature Susanna S. Epp., (2020) Discrete mathematics with applications fifth edition, page 131-160 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 17-84 Jean Gallier (2011)/ Discrete mathematics / third edition, page 397-413
11	Methods of Proof. Direct proof. Proof by contrapositive. Proof by cases. Counterexamples. Existence Proofs. Proof by contradiction. Mathematical induction. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 131-141 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 79-90 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof/ seventh edition, page 31-50 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 62-82 David Liben-Nowell(2017) - Discrete Mathematics for Computer Science, page 75-90

12	Methods of Proof. Direct proof. Proof by contrapositive. Proof by cases. Counterexamples. Existence Proofs. Proof by contradiction. Mathematical induction. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 142-148 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 81-98 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 50-69 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof/ seventh edition, page 51-70 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 83-93 David Liben-Nowell(2017) - Discrete Mathematics for Computer Science, pagee 91-100
13	Methods of Proof. Proof by contradiction. Mathematical induction. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 149-156 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 99-108 Rowan Garnier, John Taylor (2009)/ Discrete mathematics, third edition page 50-69 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof/ seventh edition, page 71-100 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 94-102 David Liben-Nowell(2017) - Discrete Mathematics for Computer Science, page101-115
14	Number theory. Divisibility Properties. Divisibility criteria. Primes. The Fundamental Theorem of Arithmetic. The Euclidean Algorithm. Modular arithmetic. Congruence. Greatest Common Divisors. Least Common Multiples. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 157-172 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 230-250 Richard Johnsonbaugh (2018) Discrete Mathematics/ Eighth Edition, page 214-249 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 250-260
15	Linear Combinations of Integers. Integer Representations. Converting integers from a b-based system to another b-based system. Arithmetic operations with numbers in a b-based system. Basic literature Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka page 173-192 Recommended literature Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 250+270 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 260-303
16	Final Exam

Prerequisites	The student must attend the course at a minimum rate of 75%.
Literature	• Leksione te pershtatura ne shqip: Matematika Diskrete-Vladimir Muka
References	• Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition. • Jon Pierre Fortney (2020) - Discrete Mathematics for Computer Science. • T Veerarajan (2019) Discrete mathematics. • Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof • Gerard O'Regan (2021)- Guide to Discrete Mathematics_ Second Edition. • Richard Johnsonbaugh (2018),Discrete Mathematics Eighth Edition. • Oscar Levin (2017) Discrete Mathematics_ An Open Introduction, Second Edition. • Gary Chartrand, Albert D. Polimeni, Ping Zhang (2018)/ Mathematical Proofs, fourth edition • Jean Gallier (2015) Discrete Mathematics. • Gary Chartrand, Ping Zhang (2011) Discrete Mathematics. • Susanna S. Epp., (2020) Discrete mathematics with applications fifth edition, • David Liben-Nowell(2017) - Discrete Mathematics for Computer Science

Course Outcome

1	Persa I perket njohurive dhe te kuptuarit, ne perfundim te kursit, studenti pritet te jete I afte te: • Shpjegoje modele baze te matematikes diskrete dhe teknologjise. • Te shpjegoje se si keto modele mund te zbatohen ne problemet perkatese.
2	Persa I perket kompetencave dhe aftesisive ne perfundim te kursit, studenti pritet te jete I afte te: • Analizoje problemet e dhena ne menyre logjike. • Te shprehe problemat ne gjuhe formale • Te zgjidhe problemat duke perdorur metoda recursive • Te zgjidhe problema kombinatorike

Course Evaluation

In-term Studies	Quantity	Percentage
Midterms	1	30
Quizzes	0	0
Projects	0	0
Term Projects	0	0
Laboratory	0	0
Class Participation	1	20
Total in-term evaluation percent		**50**
Final exam percent		**50**
Total		**100**

ECTS Workload (Based on Student Workload)

Activities	Quantity	Duration (hours)	Total (hours)
Course duration (Including the exam week: 16x Total hours of the course)	16	4	64
Study hours outside the classroom (Preparation, Practice, etc.)	14	4	56
Duties	0	0	0
Midterms	1	2	2
Final Exam	1	2	2
Other	1	1	1
Total Work Load			**125**
Total Work Load / 25 (hours)			**5.00**
ECTS			**5.00**