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	Vladimir Muka, Msc
Assistant	Sadije Bushati, Prof. Dr
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. Propositional Logic 2. Predicates and Quantifiers 3. Proof Methods 4. Sets, 5. Relations 6. Functions, 7. Algorithms 8. Divisibility 9. Mathematical induction 10. Sequencs. Progressions. 11. Sequences and sums 12. Relations 13. Correctness of programs

Course Outline

Week	Topic
1	Polynomials. Factoring. Rational Expressions. Equations. Inequalities. Exponents. Radicals. Margaret L. Lial, Raymond N. Greenwell, and Nathan P. Ritchey. (2017) Calculus with Applications, Eleventh Edition, faqe 22-50. Robert Blitzer (2018). College algebra. Miami Dade College, faqe 111-126, 173-177, 182-187 Mark Dugopolski, (2009) Algebra for College Students, fifth Edition, faqe 125-127, 377-433, 527-533 Michael Sullivan, Chicago State University (2011), Algebra & Trigonometry ninth Edition, faqe 119-134 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
2	Statements; Compound Statements; Truth Values; Evaluating the Truth of More General Compound Statements; Logical Equivalence; Tautologies and Contradictions; Summary of Logical Equivalences. Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 23 – 40. Kevin Ferland, (2017) Discrete mathematics and applications second edition, page 15-21 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka

3	Logical Equivalences Involving □; Representation of If-Then As Or; The Negation of a Conditional Statement; The Contrapositive of a Conditional Statement; The Converse and Inverse of a Conditional Statement; Only If and the Biconditional; Necessary and Sufficient Conditions; Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 41 – 60. Kevin Ferland, (2017) Discrete mathematics and applications second edition, page 33-37 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
4	The Universal Quantifier: ∀; The Existential Quantifier: ∃; Formal Versus Informal Language; Universal Conditional Statements; Equivalent Forms of Universal and Existential Statements; Implicit Quantification; Negations of Quantified Statements; Negations of Universal Conditional Statements; The Relation among ∀, ∃, ∧, and ∨; Vacuous Truth of Universal Statements; Variants of Universal Conditional Statements; Necessary and Sufficient Conditions, Only If Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 108 – 132. Kenneth H. Rosen (2018) Discrete mathematics and its applications Eighth edition, page 40 – 96. T Veerarajan (2018) Discrete mathematics page 30-49 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
5	Sets and Subsets, Set Equality, Set Operations and their properties, unions, intersections, differences, and complements, The algebraic laws of set theory. Dual statement and principle of duality. Ordered pairs and cartesian product. Power sets. T Veerarajan (2018) Discrete mathematics page 281-296 Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 336-374 Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 53-72. Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
6	Methods of Proof, Quantified Statements, direct Proof, Proof by Contrapositive, Proof by Cases, Counterexamples, Existence Proofs, Proof by Contradiction. Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 79-108 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
7	Tautologies and Contradictions; Logical Equivalences. The algebraic laws of set theory. Methods of Proof Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 35 – 40. Kenneth H. Rosen (2018) Discrete mathematics and its applications Eighth edition, page 70 – 96 Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 79-108 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
8	Midterm
9	Number Theory, Prime Number Theory, Primes and Common Divisors, Algorithms, Greatest Common Divisors, Least Common Multiple, The Euclidean Algorithm, gcds as Linear Combinations, Theory of Congruences. Gerard O'Regan (2021)- Guide to Discrete Mathematics_ Second Edition, page 55-74 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 271-290 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
10	Binary System and Computer Representation of Numbers, Modular Arithmetic, Representations of Integers, Algorithms for Integer Operations, Modular Exponentiation, Gerard O'Regan (2021)- Guide to Discrete Mathematics_ Second Edition, page 75-77 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 259-270 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
11	Relations on Sets . The Inverse of a Relation; Directed Graph of a Relation; n-ary Relations. Reflexivity, Symmetry, and Transitivity. Properties; Properties of Relations on Infinite Sets. Equivalence Relations .The Relation Induced by a Partition; Definition of an Equivalence Relation; Equivalence. Classes of an Equivalence Relation. Antisymmetry; Partial Order Relations Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 442-450 Jon Pierre Fortney (2020) - Discrete Mathematics for Computer Science-page 76-86 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 599-606 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
12	Modular Arithmetic with Applications to Cryptography. Properties of Congruence Modulo n; Finding an Inverse Modulo n. Partial Order Relations. Antisymmetry. partially and Totally Ordered Sets; Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 460-470 B.S.Vatsa, Suchi Vatsa, (2009), Discrete Mathematics, fourth Edition – page 43-50 Kenneth H. Rosen (2018)- Discrete Mathematics and Its Applications- Eighth Edition, page 607-640 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka

13	Functions; Functions Defined on General Sets.Checking Whether a Function Is Well Defined; Functions Acting on Sets. Domain and range. One-to-One Functions; One-to-One Functions on Infinite Sets; Onto Functions; Onto Functions on Infinite Sets; Relations between Exponentialand Logarithmic Functions; One-to-One Correspondences; Composition of Functions.; Composition of One-to-One Functions; Composition of Onto Functions. Inverse function Susanna S. Epp., (2010) Discrete mathematics with applications Fourth edition, page 384-427 Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page 159-183 Kevin Ferland (2017).- Discrete Mathematics and Applications- Second Edition, page 309-333 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
14	Definition and graph of numeric sequence. Factorial. Find the formula for the general term of a sequence. Recurrent formula. Arithmetic progression. The general term of an arithmetic progression. Properties of arithmetic progression. Arithmetic progression series. Sum n the first terms of an arithmetic progression. T Veerarajan (2018) Discrete mathematics page 94-116 Richard Johnsonbaugh (2014),Discrete Mathematics Seventh Edition, page 154-166 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof, page 169-177 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
15	Geometric progression. Formula for the general term. Properties of geometric progression. Geometric progression series. Infinitely decreasing geometric progression, q <1. Mathematical induction. T Veerarajan (2018) Discrete mathematics page 92-94 Gary Chartrand, Ping Zhang (2011) Discrete Mathematics, page-128 Calvin Jongsma, (2019) - Introduction to Discrete Mathematics via Logic and Proof, page 149-169 Kevin Ferland (2017).- Discrete Mathematics and Applications- Second Edition, page 227-238 Adapted lectures in Albanian: Discrete mathematics. Vladimir Muka
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 (2018) 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 (2014),Discrete Mathematics Seventh Edition. • Oscar Levin (2017) Discrete Mathematics_ An Open Introduction, Second Edition. • Kevin Ferland (2017).- Discrete Mathematics and Applications- Second Edition. • Jean Gallier (2015) Discrete Mathematics. • Gary Chartrand, Ping Zhang (2011) Discrete Mathematics.

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	35
Quizzes	0	0
Projects	0	0
Term Projects	0	0
Laboratory	0	0
Class Participation	1	15
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	0	0
Final Exam	1	5	5
Other	0	0	0
Total Work Load			**125**
Total Work Load / 25 (hours)			**5.00**
ECTS			**5.00**