CENG 203 Discrete Computational Structures							
Name	**Code**	**Semester**	**Hours/ week**	**Appl. hours**	**Lab. hours**	**Credit**	**ECTS**
Discrete Computational Structures	CENG203	1	3	-	-	3	6

Prerequisites	No
Language of Instruction	English
Type of Course	Compulsory
Level of Study	Undergraduate
Instruction Type	Face-to-Face / On-Line
Training & Teaching Techniques	Review, Theoretical lessons, Q&A, Exercises

Goal of the Course

The goal of this course is in general to teach students how to think logically and mathematically and to give them the mathematical background needed for further work in computer science. In particular, this course is aimed to introduce the computational structure concepts with an emphasis on applications in computer science.

Learning Outcomes

The students who successfully complete this course shall have

1.	necessary mathematical background for computer science and engineering
2	an ability to apply knowledge of mathematics, science, and engineering
3	an ability to design and conduct experiments, as well as to analyse and interpret data
4	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability
5	an ability to write and recognize rigorous proofs.
6	an ability to identify, formulate, and solve engineering problems

Learning Outcomes	
7	an understanding of discrete mathematics and the relevance and importance of discrete mathematics to the field of computer science.
8	an ability to construct correct mathematical arguments
9	an ability to show analytical thinking and creative problem solving skills
10	an ability to verify the validity of an argument using propositional and predicate logic.
11	an ability to solve problems using computational techniques like algebraic structures counting techniques, combinatorics and recurrence relations
12	an ability to use the techniques and skills necessary for programming practice
13	an ability to apply appropriate mathematical and statistical concepts and operations to interpret data and to solve problems
14	an ability to produce clear and mathematically rigorous arguments and demonstrate critical thinking skills
15	an ability to construct graphs and charts, interpret them, and draw appropriate conclusions
16	an ability to translate natural sentences into expressions involving propositional variables and logical connectives
17	have skills in expressing mathematical properties formally via the formal language of propositional logic and predicate logic
18	an ability to identify a problem and analyse it in terms of its significant parts and the information needed to solve it
19	an ability to formulate and evaluate possible solutions to problems, and select and defend the chosen solutions

Course Content
Fundamentals of logic, set theory, relations, functions, induction, graph theory, trees, introduction to algebraic structures, lattices.

Weekly Course Schedule (Tentative)		
Week	**Topic**	**Preliminary Assignments (Reading & Exercise)**
1	Propositional Logic	Section 1.1-1.3 (Rosen)
2	Predicate Logic (Predicates and Quantifiers, Nested Quantifiers)	Section 1.4-1.5 (Rosen)
3	Predicate Logic (Proof Methods and Strategy) Sets and Functions (Sets, Operations, Functions)	Section 1.7-1.8 (Rosen) Section 2.1-2.3 (Rosen)
4	Sets and Functions (Growth of Functions, Complexity of Algorithms)	Section 3.1-3.3 (Rosen)
5	Integers (Integers and Division, Integers and Algorithms)	Section 4.1-4.3 (Rosen) Section 9 (LLM)
6	Induction and Recursion (Sequences and Summations, Mathematical Induction, Recursive Definitions and Structural Induction, Recursive Algorithms)	Section 5.1-5.4 (Rosen)
7	Counting (The Basics of Counting, The Pigeonhole Principle)	Section 6.1-6.2 (Rosen)
8	**Mid-Term**	
9	Counting (Permutations and Combinations, Recurrence Relations, Solving Recurrence Relations)	Section 6.3-6.5 (Rosen)
10	Relations (Relations and Their Properties, Representing Relations)	Section 9.1-9.3 (Rosen)
11	Relations (Closure of Relations Equivalence Relations, Partial Orderings)	Section 9.4-9.6 (Rosen)
12	Graphs (Int to Graphs, Graph Terminology, Representing Graphs)	Section 10.1-10.3 (Rosen)
13	Graphs (Connectivity, Euler and Hamiltonian Paths, Shortest Path Problem)	Section 10.4-10.6 (Rosen)
14	Trees (Int to Trees, Applications of Trees)	Section 11.1-11.2 (Rosen)
15	Trees (Spanning Trees, Min Spanning Trees)	Section 11.4-11.5 (Rosen)
16	**Final Exam**	

Reference Books
Discrete Mathematics and Its Applications, 8th Edition, Kenneth H. Rosen
Mathematics for Computer Science, Eric Lehman, Tom Leighton, and Albert Meyer
A Course in Discrete Structures, Rafael Pass and Wei-Lung Dustin Tseng

Grading System		
Items	**Unit**	**Weight**
Attendance	-	5%
Homework	5	25%
Mid-term Exam	1	30%
Final Exam	1	40%
	Total	**100%**

Course Category	
Core Compulsory	X
Expertise/Domain	
Supportive	
Communication and Management Skills	
Transferable Skills	

Relationship between Course Learning Outcomes and Program Competencies							
No	**Program Outputs**	**Level of Contribution**					
		1	**2**	**3**	**4**	**5**
1	an ability to apply knowledge of mathematics, science, and engineering					X
2	an ability to design and conduct experiments, as well as to analyse and interpret data					X
3	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability				X	
4	an ability to write and recognize rigorous proofs.					X
5	an ability to function on multidisciplinary teams		X			

Relationship between Course Learning Outcomes and Program Competencies							
No	**Program Outputs**	**Level of Contribution**					
		1	**2**	**3**	**4**	**5**	
6	an ability to identify, formulate, and solve engineering problems					X	
7	an understanding of professional and ethical responsibility		X				
8	an ability to communicate effectively			X			
9	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context			X			
10	a recognition of the need for, and an ability to engage in life-long learning		X				
11	a knowledge of contemporary issues		X				
12	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice				X		
13	an ability to apply design and development principles in the construction of software systems of varying complexity.			X			

ECTS/Work-Load			
Activities	**Unit**	**Duration (Hour)**	**Total Work-Load**
Total Course Hours (Exams are included: 16 x course hours/week)	16	3	48
Laboratory	-	-	-
Practice	-	-	-
Course Related Internship	-	-	-
Field Study	-	-	-
Working Time (Outside Class Study)	16	2	32
Presentation	-	-	-
Projects	-	-	-
Reports	-	-	-
Homeworks	5	2	10
Quizzes	-	-	-
Mid-Term Exams	1	15	15
Final Exam	1	15	15
Total	**(120/40 = 3)**		**120**