



جمهورية مصر العربية

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research



المعهد العالى للحاسبات وتكنولوجيا المعلومات
مدينة الشروق - القاهرة
شعبة علوم الحاسب

Course specification

Course Code: BS 103

Course Title: Discrete Mathematics

Academic Year: 2023/2024

Course specification
(BS 103 Discrete Mathematics)

Course Outline	
Faculty:	<i>HICIT- (Higher Institute for Computers & Information Technology-El Shorouk Academy)</i>
Program (s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of program:	Compulsory
Department offering the program	Department of Computer Science
Department offering the course:	Department of Computer Science
Level	First Level
Date of specification approval	--/--/2023

Basic Information			
Code:	<i>BS103</i>	Title:	<i>Discrete Mathematics</i>
Prerequisites:	<i>BS 101 Calculus</i>		
Weekly Hours:			
Lecture: 2	Exercise: ۲	Practical: -	Total: 3 credit hours

Professional Information
<p><u>Course Aims:</u></p> <p>Upon successful completion of BS103, students should understand the basic concepts of: -</p> <ul style="list-style-type: none"> - Set Theory, Relations, and Functions. - Vectors and Matrices. - Graph Theory. - Combinatorial Analysis. - Algebraic Systems, Formal Languages. - Propositional Calculus. - Boolean Algebra.

Program ILOs Covered by Course

Knowledge and understanding	Intellectual Skills	Professional and practical skills	General and Transferable skills
a1, a4	b1, b7, b8	c16	d11

a1	Understand the essential mathematics relevant to computer science.
a4	Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics, and statistics.
b1	Define traditional and non-traditional problems, set goals towards solving them, and observe results.
b7	Establish criteria and verify solutions.
b8	Identify a range of solutions and critically evaluate and justify proposed design solutions.
c16	Apply tools and techniques for the design and development of applications.
d11	Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.

Intended learning outcomes of course (ILOs)

a. Knowledge and Under-Standing:

- a1. Identify the sets, relations, and functions. [a1, a4]
- a2. Describe the graphical systems. [a1]
- a3. Explain the principles, concepts, and practical design of Boolean and logical systems. [a1, a4]

b. Intellectual Skills:

- b1. Analyze the problems including Sets, Relations, and Functions. [b1, b7]
- b2. Identify appropriate methods of proof. [b7, b8]
- b3. Identify a range of solutions and critically evaluate and justify proposed design solutions. [b8]

c. Professional and practical skills

- c1. Solve related problems in sets, sequences, and series. [c16]

d. General and transferable skills

- d1. Communicate effectively by oral, written, and visual means. [d11]
- d2. Work effectively as an individual and as a member of a team. [d11]
- d3. Develop Creativity and imagination skills, Self-assessment ability and Critical thinking and analytic ability. [d11]

Contents		
Topic	Contact Hours	
	lecture	Lab
SET THEORY <ul style="list-style-type: none"> • Sets and elements • Universal set, empty set, and Subsets. • Venn diagrams, Set operations, Algebra of sets, Duality. • Finite sets, counting principle, Classes of sets, power sets. • Arguments and Venn diagrams • Mathematical induction 	4	4
RELATIONS <ul style="list-style-type: none"> • Product sets. Relations. Pictorial representations of relations. • Inverse relations. Composition of relations. • Properties of relations. Partitions. Equivalence relations. • Partial ordering relations • n-array relations. 	4	4
FUNCTIONS <ul style="list-style-type: none"> • Functions, Graph of function. • One-to-one, onto and invertible functions. • Indexed classes of sets. • Cardinality. 		
PROPOSITION CALCULUS <ul style="list-style-type: none"> • Statement and compound statements • Conjunction p AND q. Disjunction, p OR q Negation, NOT p. • Propositions and truth tables. • Tautologies and contradictions. Logical equivalence. • Algebra of propositions. • Conditional and biconditional statements. 	6	6
VECTORS AND MATRICES <ul style="list-style-type: none"> • Vectors, Matrices. Matrix addition and scalar multiplication. • Summation symbol. Matrix multiplication. • Transpose, Square matrices. • Invertible matrices. Determinants. 	4	4
GRAPH THEORY <ul style="list-style-type: none"> • Graphs and multigraphs. Degree, Connectivity. • The bridges of Konigsberg, traversable multigraphs. • Special graphs. Matrices and graphs. • Labeled graphs. Isomorphic graphs. • Directed graphs. 	4	4
COMBINATORIAL ANALYSIS <ul style="list-style-type: none"> • Fundamental principle of counting. • Binomial coefficients. • Permutations. • Combinations • Ordered Partitions. • Tree diagram 	4	4

BOOLEAN ALGEBRA <ul style="list-style-type: none"> • Basic definitions • Duality • Basic Theorems. • Boolean Algebra as lattices. • Representation Theorem. Disjunctive normal form for sets. • Minimal Boolean expressions.Karnaugh maps. 	4	4
SELECTED TOPIC <ul style="list-style-type: none"> • Elementary Number Theory and Methods of Proof • Sequences, Mathematical Induction, and Recursion 	2	2

Teaching and learning methods	
Teaching and learning methods	Used
Active Learning	
Lectures (blended learning – online learning using virtual classroom)	√
Tutorial Exercises (hybrid learning – online learning)	√
Practical Lab (blended learning – online learning)	-
Exercises	√
Discussions.	√
Self – Learning strategy	
Reading material	-
Websites search	√
Research and reporting	√
Self-studies	√
Experimental strategy	
Group work	-
Presentation	-
Problem solving strategy	
Problem solving / problem solving learning based	√
Case study	√
Synchronous E-Learning	
Virtual lab	-
Virtual class	-
Chat Room	√
Video lectures	√
Asynchronous E-Learning	
E-Learning	√

Student assessment methods & Schedule			
Methods	Assessment	Used	Week#
(Electronic) Midterm Exam	To assess the knowledge and understanding achieved by the student during the previous weeks. (Online on e-learning hub, FTF)	√	8
Pencil-to-Paper Final Exam	To evaluate what the student gain at the end of the course, and to assess the knowledge and understanding, general skills, and intellectual skills.	√	16
Course Project	To allow students work in team, and to evaluate knowledge, understanding, intellectual, and transferable skills. (Online on e-learning hub, FTF)	-	
Electronic Course Work & Quizzes	To keep the student always in the course, and to evaluate knowledge, understanding, intellectual, and transferable skills. (Online on e-learning hub)	√	2-14
Practical Exam	To measure the ability of students to design and implement a software program (FTF).	-	
Participation	To assess the knowledge and understanding achieved by the student during the previous weeks.	√	3-14

Assessment Weight	
Assessment	Weight %
Participation	5 %
Electronic Mid Term Exam	10 %
Final Exam	80 %
Electronic / hard copy Course Work & Quizzes	5 %
Total	100

Course Work & Quizzes
Short Exams, Assignments, Research, Reports, Presentations on e-learning hub
Class / Project discussion in a virtual classroom

List of references	
Essential books (textbooks)	<ul style="list-style-type: none"> Lipschutz, Seymour, and Marc Lipson. <i>Schaum's outline of discrete mathematics</i>. McGraw Hill Professional, 2021. Epp, Susanna S. <i>Discrete mathematics with applications</i>. Cengage learning, 2010.
Course notes	<ul style="list-style-type: none"> -----
Recommended books	<ul style="list-style-type: none"> Knuth, Donald E. <i>Art of computer programming, volume 2: Seminumerical algorithms</i>. Addison-Wesley Professional, 2014. Rosen, Kenneth H., ed. <i>Handbook of discrete and combinatorial mathematics</i>. CRC press, 2017. Edition, Seventh, and Kenneth H. Rosen. "Discrete Mathematics and Its Applications.", Companion Web site: http://www.mhhe.com/math/advmath/rosen/

	<ul style="list-style-type: none"> • Neville Dean, <i>Essence of Discrete Mathematics</i> Prentice Hall. ISBN 0-13-345943-8. Not as in depth as above texts, but a gentle intro. • Klette, R., and A. Rosenfeld (2004). <i>Digital Geometry</i>. Morgan Kaufmann. ISBN 1-55860-861-3. Also, on (digital) topology, graph theory, combinatorics, axiomatic systems. • Mathematics Archives, Discrete Mathematics links to syllabi, tutorials, programs, etc. http://archives.math.utk.edu/topics/discreteMath.html • Graham, Ronald L., et al. "Concrete mathematics: a foundation for computer science." <i>Computers in Physics</i> 3.5 (1989): 106-107 • Cheadle, Andrew M., et al. "A Tutorial Introduction." (2013). • Grimaldi, Ralph P. <i>Discrete and Combinatorial Mathematics; An Applied Introduction</i>. Addison-Wesley Longman Publishing Co., Inc., 1985.
Periodicals, website	

Required Facilities

Tools & SW (Technology facilities):	<ul style="list-style-type: none"> - Data show and PC computer. - Microsoft TEAMS to create virtual classrooms for lectures and tutorials. - Portal (MOODLE) to make electronic quizzes and electronic midterm exam. - Portal (MOODLE) to upload project deliverable and assignment. - Academy portal (MOODLE) to upload electronic material. 		
Teaching facilities:	Whiteboard		√
	Computer Lab		√
	Data show		√
	E-Learning		√
	Videos		√
	Website		√

Course Content/ILO Matrix

Course Contents	Knowledge & understanding			Intellectual skills			Professional and practical skills	General		
	A1	A2	A3	B1	B2	B3	C1	D1	D2	D3
Set Theory	√		√	√	√			√		
Relations	√		√	√				√		

Functions	√		√	√				√		
Proposition Calculus		√		√	√	√	√		√	√
Vectors and Matrices		√	√		√	√	√			
Graph Theory		√	√		√	√	√	√	√	√
Combinatorial Analysis		√		√	√	√	√	√	√	√
Boolean Algebra		√		√	√	√	√			√
Selected Topic					√	√	√	√	√	

Learning Method /ILOs Matrix

Learning Methods	Knowledge and understanding			Intellectual skills			Professional and practical skills	General		
	a1	a2	a3	b1	b2	b3	c1	d1	d2	d3
Lectures	√	√	√	√	√	√	√			
Tutorial Exercises	√	√	√	√	√	√	√	√	√	√
Reading material	√	√	√	√	√	√	√			
Websites search	√	√	√	√	√	√		√	√	√
Research and reporting	√	√	√					√	√	√
Problem solving				√	√	√				
Group work							√	√	√	√
Case study										
Practical Lab										
Discussions.				√	√	√	√	√	√	√

Assessment Methods /ILOs Matrix

Assessment Methods	Knowledge & understanding			Intellectual skills			Professional and practical skills	General		
	a1	a2	a3	b1	b2	b3	c1	d1	d2	d3
Electronic Mid Term Exam	√	√	√	√	√	√	√			
Final Exam	√	√	√	√	√	√	√			
Electronic Course Project										
Electronic Course Work & Quizzes	√	√	√	√	√	√	√	√	√	√
Practical Exam										

Course ILOs Vs Program ILOs								
Course ILOs		Knowledge & understanding		Intellectual skills			Professional and practical skills	General
		A1	A4	B1	B7	B8	C16	D11
Knowledge and Understanding	a1	X	X					
	a2	X					X	
	a3	X	X					
Intellectual skills	b1			X	X			X
	b2				X			
	b3					X		
Professional and practical skills	c1						X	
General skills	d1							X
	d2							X
	d3							X

Course Coordinator : Dr. Farouk Shaaban ()

Head of Department : Dr. Ahmed El-Abbassy ()

Date: --/--/2023