Course specification

(1102 Discrete structure)

Faculty	HICIT - **Higher Institute for Computers & Information Technology** – *El-Shorouk Academy*	
Programme(s) on which the course is given:	Undergraduate program in Computer Science	
Major or minor element of programme:	Compulsory	
Department offering the programme	Department of Computer Science	
Department offering the course:	Department of Computer Science	
Year / Class	1st Year – 1st Semester	
Date of specification approval	1/8/2022	

A- Basic Information

Title : Discrete structure	*Code: 1102*		
Weekly Hours:			
Lecture: 3	**Exercise: 2**	**Practical:**	**Total:** 5

B- Professional Information

1- Course Aims:

Upon successful completion of CS1102, students should understand the basic concepts of: -
- Set Theory, Relations, and Functions.
- Vectors and Matrices.
- Graph Theory.
- Combinatorial Analysis.
- Algebraic Systems, Formal Languages.
- Propositional Calculus.
- Boolean Algebra.

2- Program ILOs Covered by Course

Program Intended Learning Outcomes			
Knowledge and understanding	**Intellectual Skills**	**Professional and practical skills**	**General and Transferable skills**
A1, A4	**B1, B7, B8**	**C16**	**D11**

3- 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]

4- Contents

Topic	Hours	Lec.	Exc/Lab
SET THEROY • 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	10	6	4
RELATIONS • Product sets. Relations. Pictorial representations of relations. • Inverse relations. Composition of relations. • Properties of relations. Partitions. Equivalence relations. • Partial ordering relations • n-array relations. **FUNCTIONS** • Functions, Graph of function. • One-to-one, onto and invertible functions. • Indexed classes of sets. • Cardinality.	10	6	4

Topic			
PROPOSITION CALCULUS • 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.	10	6	4
VECTORS AND MATRICES • Vectors, Matrices. Matrix addition and scalar multiplication. • Summation symbol. Matrix multiplication. • Transpose, Square matrices. • Invertible matrices. Determinants.	5	3	2
GRAPH THEORY • Graphs and multigraphs. Degree, Connectivity. • The bridges of Konigsberg, traversable multigraphs. • Special graphs. Matrices and graphs. • Labeled graphs. Isomorphic graphs. • Directed graphs.	10	6	4
COMBINATORIAL ANALYSIS • Fundamental principle of counting. • Binomial coefficients. • Permutations. • Combinations • Ordered Partitions. • Tree diagram.	10	6	4
BOOLEAN ALGEBRA • Basic definitions • Duality • Basic Theorems. • Boolean Algebra as lattices. • Representation Theorem. Disjunctive normal form for sets. • Minimal Boolean expressions. • Karnaugh maps.	10	6	4
SELECTED TOPIC	5	3	2

5- Teaching and learning methods

Teaching and learning methods	Used
Active Learning	
Lectures (blending learning – online learning using virtual classroom)	√
Tutorial Exercises (hybrid learning – online learning)	√
Practical Lab (blending 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	√

6- Student assessment methods

Methods	Assessment	Used
Electronic Midterm Exam	To assess the knowledge and understanding achieved by the student during the previous weeks. (Online on e-learning hub)	√
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.	√
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)	√
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.	√

Assessment Schedule

Assessment	Week #
Participation	3 - 14
Electronic Mid Term Exam	8
Final Exam	16
Electronic / hard copy Course Work & Quizzes	2 - 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:
  o Short Exams, Assignments, Research, Reports, Presentations on e-learning hub
  o Class / Project discussion in a virtual classroom

7- 6- List of references

Essential books (textbooks)	• Lipschutz, Seymour, and Marc Lipson. *Schaum's outline of discrete mathematics*. McGraw Hill Professional, 2021. • Epp, Susanna S. *Discrete mathematics with applications*. Cengage learning, 2010.
Recommended books	• Knuth, Donald E. *Art of computer programming, volume 2: Seminumerical algorithms.* Addison-Wesley Professional, 2014. • Rosen, Kenneth H., ed. *Handbook of discrete and combinatorial mathematics.* CRC press, 2017. • Edition, Seventh, and Kenneth H. Rosen. "Discrete Mathematics and Its Applications.", Companion Web site: http://www.mhhe.com/math/advmath/rosen/ • Neville Dean, Essence of Discrete Mathematics Prentice Hall. ISBN 0-13-345943-8. Not as in depth as above texts, but a gentle intro. • Klette, R., and A. Rosenfeld (2004). Digital Geometry. 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." *Computers in Physics* 3.5 (1989): 106-107 • Cheadle, Andrew M., et al. "A Tutorial Introduction." (2013). • Grimaldi, Ralph P. *Discrete and Combinatorial Mathematics; An Applied Introduction*. Addison-Wesley Longman Publishing Co., Inc., 1985.
Periodicals, website	• PowerPoint presentations of all course materials • All tutorials material [https://moodle.sha.edu.eg/course/view.php?id=1353]

8- Required Facilities

To assess professional and practical skills given the following facilities:

a. Tools & SW (Technologies facilities):

– 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.

b. Teaching facilities:

	Lecture	*class*	*Lab*
Whiteboard	used	used	-
Pc / laptop	used	used	-
Data show	used	used	-
Webinars	MS TEAMS	MS TEAMS	-
Social Media	Facebook Page for 3rd year	Facebook Page for 3rd year	-
Chat Room	Chat Teams	Chat Teams	-
Videos	Stream-MOODLE	Stream-MOODLE	-
Website	MOODLE	MOODLE	-

9- Course Matrices

a. Course Content / ILOs Matrix

Course Contents	Knowledge & understanding			Intellectual skills			Professional and practical skills	General		
	a1	a2	a3	b1	b2	b3	c1	d1	d2	d3
Set Theory	X		X	X	X			X		
Relations	X		X	X				X		
Functions	X		X	X				X		
Proposition Calculus		X		X	X	X	X		X	X
Vectors and Matrices		X	X		X	X	X			
Graph Theory		X	X		X	X	X	X	X	X
Combinatorial Analysis		X		X	X	X	X	X	X	X
Boolean Algebra		X		X	X	X	X			X
Selected Topic					X	X	X	X	X	

b. Learning Method / ILOs Matrix

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

c. 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	X	X	X	X	X	X	X			
Final Exam	X	X	X	X	X	X	X			
Electronic Course Project										
Electronic Course Work & Quizzes	X	X	X	X	X	X	X	X	X	X
Practical Exam										

d. Course ILOs Vs Program ILOs

Course ILOs	Prog ILOs	Knowledge & understanding		Intellectual skills			Professional and practical skills	General skills
		A1	A4	B1	B7	B8	C16	D11
K&U	a1	X	X					
	a2	X						
	a3	X	X					
Int.	b1			X	X			
	b2				X	X		
	b3					X		
P. &P.	c1						X	
General	d1							X
	d2							X
	d3							X

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