University of Bahrain
Quality Assurance and Accreditation Center

Course Syllabus Form

1. Course code:	**ITCS255**	**2. Course title:**	Discrete Structures II

3. College: **Information Technology**

4. Department: **Computer Science**

5. Program:
B.Sc. in Computer Science,
B.Sc. in Computer Science – Cloud Computing

6. Course credits: **3-2-3**

7. Course NQF Level: **6**

8. NQF Credits: **12**

9. Prerequisite: **ITCS254**

10. Lectures Timing & Location:

Section 01: UTH	11:00 – 11:50	Location S40 - 2049
Section 02: MW	08:00 – 09:15	Location S40 - 2048
Section 03: MW	09:30 – 10:45	Location S40 - 2048

11. Course web page: **http://blackboard.uob.edu.bh/**

12. Course Instructor: **Dr. Ali Alsaffar**

13. Office Hours and Location: TBA

14. Course coordinator: **Dr. Ali Alsaffar**

15. Academic year: 2023-2024

16. Semester:		**First**	✓	**Second**		**Summer**

17. Textbook(s):
Rosen, Kenneth H., Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill, 2019

18. References:
- Richard Johnonbaugh, Discrete mathematics, 8th edition, Prentice Hall, 2018
- Susanna S. Epp, Discrete Mathematics with Applications, 5th edition, Cengage, 2020

19. Other learning resources used (e.g., e-Learning, field visits, periodicals, software, etc.):
Blackboard (e-Learning)
MS Teams

20. Course description (as published):

This course is a continuation of discrete structures I. Topics include elementary number theory, asymptotic notations of growth of functions, recurrence relations and their solutions, graphs and trees, combinatorics.

21. Course Intended Learning Outcomes (CILOs):

	Mapping to PILOs					
CILOs	**1**	**2**	**3**	**4**	**5**	**6**
1. Describe the concepts of asymptotic notations big O, omega, and theta to give asymptotic upper, lower, and tight bounds of functions, respectively.						X
2. Interpret and recognize the basic concepts of elementary number theory such as divisibility of integers, prime numbers, congruence, and Euclid's algorithm for finding greatest common divisors.						X
3. Solve problems involving recurrence relations.						X
4. Examine and solve discrete mathematics problems that involve computing permutations and combinations of a set, fundamental enumeration principles, inclusion-exclusion principle, Pigeonhole principle and Binomial theorem.						X
5. Identify the basic properties and concepts of graphs and trees and use them to model simple applications.						X

22. Course assessment:

Assessment Type	*Details/ Explanation of Assessment in relation to CILOs*	*Number*	*Weight*	*Date(s)*
Quizzes	As shown in table 24	2	10%	As shown in table 24
Test #1	Covers Growth Functions, Number Theory, and Recurrence Relations (First Part). **CILOs: 1, 2, 3**	1	20 %	TBA
Test #2	Covers Recurrence Relations (Second Part) Graphs, and Trees. **CILOs: 3, 4**	1	20 %	TBA
Lab Assignments/Practical	–	–	–	–
Assignments	As shown in table 24	4	10%	As shown in table 24
Projects/Case Studies	–	–	–	–
Final Examination	Comprehensive **CILOs: 1, 2, 3, 4, 5**	1	40%	T, June 4th, 2024 11:30-1:30 PM
Total			100%	

23. Description of Topics Covered

Topic Title	***Description***

(e.g., chapter/experiment title)	
The Growth of Functions. Section 3 (Sec. 3.2)	Introducing the asymptotic notations big O, omega, and theta to describe the asymptotic upper, lower, and tight bounds of functions
Number Theory. Chapter 4 (Sec. 4.1, 4.3 and 4.4)	Presenting the basic concepts of elementary number theory.
Recurrence Relations. Chapter 8 (Sec. 8.2)	Finding solutions to recurrence relations using varieties of methods and techniques.
Counting (Combinatorics). Chapter 6 (Sec. 6.1– 6.5)	Study important combinatorial tools such as the basic rules of counting, inclusion-exclusion principle, the pigeonhole principle, permutations and combinations of a set, and Binomial theorem.
Graphs. Chapter 10 (Sect. 10.1 – 10.6)	Introduction to graph theory. Study graphs and graph models, graph terminology, representing graphs and graph Isomorphism, connectivity, Euler path, and Shortest-Path problems.
Trees. Chapter 11 (Sec. 11.1, 11.3 – 11.5)	Study trees. Topics include applications of trees, rooted trees, properties of trees, spanning trees and minimum spanning trees.

24. Weekly Schedule

Week	*Date*	*Topics covered*	*CILOs*	*Teaching Method*	*Assessment*
1	11-Feb-24	**The Growth of Functions:** (Sec. 3.2) Introduction; Big-O Notation; Big-O Estimates for Some Important Functions;	1	*Interactive Teaching + Problem Solving* **Tutorial**: Learning LaTeX software	
2	18-Feb-24	(Sec. 3.2 cont.) The Growth of Combinations of Functions; Big-Omega and Big-Theta Notation;	1	*Interactive Teaching + Problem Solving* **Tutorial on Growth of Functions**	
3	25-Feb-24	**Number Theory:** (Sec. 4.1) Divisibility and Modular Arithmetic (Introduction; Division; The Division Algorithm; Modular Arithmetic); (Sec. 4.3) Primes and Greatest Common Divisors (Introduction; Primes; Trial Division; Greatest Common Divisors and Least Common Multiples);	2	*Interactive Teaching + Problem Solving* **Tutorial on Growth of Functions**	**Quiz#1 Growth of Functions**
4	03-Mar-24	(Sec. 4.3 cont.) The Euclidean Algorithm; GCDs as Linear Combinations; (Sec. 4.4) Solving Congruences (Introduction; Linear Congruences).	2	*Interactive Teaching + Problem Solving* **Tutorial on Number Theory**	**HW #1** Growth of Functions
5	10-Mar-24	**Introduction to Recurrence Relations:** (Sec. 2.4) Mathematical Review, (Sequences and Summations). Solving Recurrence Relations using Iteration Methods (Forward/Backward Substitution)	3	*Interactive Teaching + Problem Solving* **Tutorial on Number Theory**	**Quiz #2 Number Theory + Recurrence Relations**
6	17-Mar-24	**Solving Recurrence Relations:** (Sec. 8.2) Iteration/Back Substitution methods, Linear Homogeneous with	3	*Interactive Teaching + Problem Solving* **Tutorial on**	**HW #2** Numbering + Recurrence

		Constant Coefficients – distinct and repeated roots; Linear Nonhomogeneous with Constant Coefficients.		**Recurrence Relations**	Relations
7	24-Mar-24	**Combinatorics**: (Sec. 6.1) The Basics of Counting – Basic Counting Principles (Product and Sum Rules); The subtraction Rule (The Principle of Inclusion-Exclusion); (Sec. 6.2) Pigeonhole Principle.	4	*Interactive Teaching + Problem Solving* **Tutorial on Recurrence Relations**	
8	31-Mar-24	**Semester Break**			
9	07-Apr-24	(Sec. 6.3) Permutations; Combinations.	4	*Interactive Teaching + Problem Solving* **Tutorial on Combinatorics**	**Quiz #3** Recurrence Relations
10	14-Apr-24	(Sec. 6.4) Binomial Coefficients and Identities – Binomial Theorem and Pascal's Identity and Triangle; (Sec. 6.5) Generalized Permutations and Combinations.	4	*Interactive Teaching + Problem Solving* **Tutorial on Combinatorics**	**HW #3** Recurrence Relations + Combinatorics
11	21-Apr-24	**Graphs.** (Sec. 10.1) Graphs and Graph Models; (Sec. 10.2) Graph Terminology and Special Types of Graphs.	5	*Interactive Teaching + Problem Solving* **Tutorial on Combinatorics**	
12	28-Apr-24	(Sec. 10.3) Representing Graphs and Graph Isomorphism.	5	*Interactive Teaching + Problem Solving* **Tutorial on Graphs**	**Quiz #4** Recurrence Relations + Combinatorics
13	05-May-24	(Sec. 10.4) Connectivity: Paths and Cycles; (Sec. 10.5) Euler Paths and Circuits; (Sec. 10.6) Shortest-Path Problems.	5	*Interactive Teaching + Problem Solving* **Tutorial on Graphs**	
14	12-May-24	**Trees:** (Sec. 11.1) Introduction to Trees – Rooted Trees and Properties of Trees.	5	*Interactive Teaching + Problem Solving* **Tutorial on Graphs**	**HW #4** Graphs + Trees
15	19-May-24	(Sec. 11.4) Spanning Trees; (Sec. 11.5) Minimal Spanning Trees.	5	*Interactive Teaching + Problem Solving* **Tutorial on Trees**	
16	26-May-24	**Review**			

Academic Integrity Statement

Honesty and integrity are integral components of the academic process. Students are expected to be honest and ethical at all times in their pursuit of academic goals in accordance with the Regulations of Professional Conduct Violations for University of Bahrain Students, the UOB Plagiarism Policy and the UOB Guide to Students Rights and Duties. Any breach of academic integrity will be dealt according to the University Regulations for Professional Conduct Violations.

Prepared by: Dr. Ali Alsaffar

Date: 04 September 2023