Form: **Course Syllabus**	**Form Number**	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	08

1.	**Course Title**	**Theory of Algorithms**
2.	**Course Number**	0301374
3.	**Credit Hours (Theory, Practical)**	3
	Contact Hours (Theory, Practical)	3
4.	**Prerequisites/ Corequisites**	0301211
5.	**Program Title**	
6.	**Program Code**	
7.	**School/ Center**	Science
8.	**Department**	Mathematics
9.	**Course Level**	Optional Specialization requirement
10.	**Year of Study and Semester (s)**	Third year
11.	**Other Department(s) Involved in Teaching the Course**	None
12.	**Main Learning Language**	English
13.	**Learning Types**	☑Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	☑Moodle ☑Microsoft Teams
15.	**Issuing Date**	
16.	**Revision Date**	

17. Course Coordinator:

Name: Baha Alzalg Office number: 204 Email: b.alzalg@ju.edu.jo	Contact hours: Phone number:

18. Other Instructors:

Name: Banan Maayah Office number: 310 Phone number: Email: b.maayah@ju.edu.jo Contact hours:

19. Course Description:

Definition of an algorithm, analysis of algorithms, asymptotic analysis, Big Oh, Omega and Theta notations, recurrence equations, recursive and nonrecursive algorithms, the concept of worst, best, and average case performance analysis, the complexity class NP-complete, applications on matrix algorithms, searching and sorting algorithms, Euclid's algorithm, introduction to graphs, graph algorithms.

20. Program Student Outcomes (SO's):

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Identify, formulate, and solve broadly-defined technical or scientific problems by applying knowledge of Mathematics and Science and/or technical topics to areas relevant to the discipline.

2. Formulate or design a system, process, procedure or program to meet desired needs.

7. Utilize research methods, critical and creative thinking skills to assess and analyze information) to solve problems properly, then draw valid reasoning and logical conclusions leading to true consequences.

8. Utilize techniques, skills, and modern scientific tools such as mathematical packages, statistical software, graphing calculators, and online resources necessary for professional practice.

21. Course Intended Learning Outcomes (CLO's):

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Understand fundamental concepts in algorithmic analysis, and the importance of asymptotic notations (Big Oh, Omega and Theta notations) in evaluating algorithm performance.
2. Apply asymptotic analysis to evaluate the worst-case, best-case, and average-case performance of different algorithms.
3. Develop and assess the efficiency of algorithms for fundamental operations involving matrix and numeric algorithms, sorting and searching algorithms, and Euclid's algorithm.
4. Utilize algorithmic techniques and strategies to solve real-world computational problems involving graph algorithms such as breadth-first search, depth-first search, and topological sort.
5. Compare the efficiency of different algorithms for solving the same problem, and justify the choice of an algorithm based on performance criteria.

Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1	●	●		●		
2		●	●	●		
3		●	●		●	
4		●	●		●	
5			●	●	●	●

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)	SO (8)
CLO (1)	●							
CLO (2)	●						●	
CLO (3)	●	●						●
CLO (4)	●	●						●
CLO (5)							●	●

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1	Review of Relations, Sets and Functions	1	FF	Moodle M.Teams	S		Textbook
	1.2	Review of Sequences and Matrices	1	FF	Moodle M.Teams	S		Textbook
	1.3	Constructing Algorithms	1	FF	Moodle M.Teams	S		Textbook
2	2.1	Constructing Algorithms	1	FF	Moodle M.Teams	S		Textbook
	2.2	Comparing Algorithms	1	FF	Moodle M.Teams	S		Textbook
	2.3	Runtime Analysis: Line-by-Line Analysis	1, 2	FF	Moodle M.Teams	S		Textbook
3	3.1	Runtime Analysis: Types (Worst, Best, and Average Case)	1, 2	FF	Moodle M.Teams	S		Textbook
	3.2	Runtime Analysis: Looping	1, 2	FF	Moodle M.Teams	S		Textbook
	3.3	Runtime Analysis: Upper and Lower Bounds	1, 2	FF	Moodle M.Teams	S		Textbook
4	4.1	Notations: Big Oh	1, 2	FF	Moodle M.Teams	S		Textbook
	4.2	Notations: Big Omega and Big Theta	1, 2	FF	Moodle M.Teams	S		Textbook
	4.3	Notations: Properties	1, 2	FF	Moodle M.Teams	S		Textbook
5	5.1	Notations: Limit Characterizations	1, 2	FF	Moodle M.Teams	S		Textbook
	5.2	Algorithms Based on the Notations.	1, 2	FF	Moodle M.Teams	S		Textbook
	5.3	Decision-Making Statements	1, 2	FF	Moodle M.Teams	S		Textbook
	6.1	Analyzing Algorithms Without Function Calls	1, 2	FF	Moodle M.Teams	S		Textbook

6	6.2	Analyzing Algorithms Without Function Calls	1, 2	FF	Moodle M.Teams	S		Textbook
	6.3	Analyzing Algorithms With Function Calls: Non-recursive Programs	1, 2	FF	Moodle M.Teams	S		Textbook
7	7.1	Analyzing Algorithms With Function Calls: Recursive Programs	1, 2	FF	Moodle M.Teams	S		Textbook
	7.2	Complexity Class NP-Complete	1, 2	FF	Moodle M.Teams	S		Textbook
	7.3	Solve Problems	1, 2	FF	Moodle M.Teams	S		Textbook
8	8.1	Matrix–Vector Multiplication Algorithms	2, 3	FF	Moodle M.Teams	S		Textbook
	8.2	Matrix–Matrix Multiplication Algorithms	2, 3, 5	FF	Moodle M.Teams	S		Textbook
	8.3	Linear-time Search Algorithm, Binary Search Algorithm	2, 3, 5	FF	Moodle M.Teams	S		Textbook
9	9.1	Insertion Sort Algorithm	2, 3, 5	FF	Moodle M.Teams	S		Textbook
	9.2	Selection Sort Algorithm	2, 3, 5	FF	Moodle M.Teams	S		Textbook
	9.3	Euclid's Algorithm	2, 3	FF	Moodle M.Teams	S		Textbook
10	10.1	Numeric Algorithms	2, 3	FF	Moodle M.Teams	S		Textbook
	10.2	Numeric Algorithms	2, 3	FF	Moodle M.Teams	S		Textbook
	10.3	Solve Problems	2, 3, 5	FF	Moodle M.Teams	S		Textbook
11	11.1	Basic Graph Definitions.	1	FF	Moodle M.Teams	S		Textbook
	11.2	Properties of Graphs	1	FF	Moodle M.Teams	S		Textbook
	11.3	Graph Coloring	1	FF	Moodle M.Teams	S		Textbook
12	12.1	Directed Graphs	1	FF	Moodle M.Teams	S		Textbook
	12.2	Graph Representations: Adjacency List	1	FF	Moodle M.Teams	S		Textbook
	12.3	Graph Representations: Adjacency Matrix	1	FF	Moodle M.Teams	S		Textbook

13	13.1	Breadth-First Search Algorithm	2, 4	FF	Moodle M.Teams	S		Textbook
	13.2	- Applications (Spanning Trees)	2, 4	FF	Moodle M.Teams	S		Textbook
	13.3	- Applications (Shortest Paths)	2, 4	FF	Moodle M.Teams	S		Textbook
14	14.1	- Applications (Testing Bipartiteness)	2, 4	FF	Moodle M.Teams	S		Textbook
	14.2	Depth-first Search Algorithm	2, 4	FF	Moodle M.Teams	S		Textbook
	14.3	-Applications (Spanning Trees)	2, 4	FF	Moodle M.Teams	S		Textbook
15	15.1	-Applications (Detecting Cycles)	2, 4	FF	Moodle M.Teams	S		Textbook
	15.2	Topological Sorting Algorithm	2, 4	FF	Moodle M.Teams	S		Textbook
	15.3	Solve Problems	2, 4, 5	FF	Moodle M.Teams	S		Textbook
16	16.1	Final Exam	1-5	FF		S		

24. Evaluation Methods:

Opportunities to demonstrate achievement of the CLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
First Exam	20		1, 2, 5	6	On Campus
Mid Term	30		3, 4, 5	12	On Campus
Final Exam	50	All topics	1-5	16	On Campus

25. Course Requirements:

- Computer.
- Account on Microsoft Teams.

26. Course Policies:

A. Attendance policies: Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor

B. Absences from exams and submitting assignments on time: If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course

C. Health and safety procedures: Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes

D. Honesty policy regarding cheating, plagiarism, misbehavior: Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.

E. Grading policy: Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.

F. Available university services that support achievement in the course: Math library, Computer lab.

27. References:

A. Required book(s), assigned reading and audio-visuals:

-*Algorithmic Mathematics*. 1st Edition. Springer (2016) by Stefan Hougardy and Jens Vygen.

-*Combinatorial and Algorithmic Mathematics: From Foundation to Optimization*. 1st edition. John Wiley & Sons (2024) by Baha Alzalg.

B. Recommended books, materials, and media:

-*Introduction to Algorithms.* 3rd edition. MIT Press (2009) by Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein.

28. Additional information:

Name of the Instructor or the Course Coordinator: **Prof. Baha Alzalg**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ Department: **Dr. Manal Ghanem**	Signature: ……	Date: ……
Name of the Head of Department: **Prof. Baha Alzalg**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ School of Science: **Prof. Emad A. Abuosba**	Signature: ……	Date: ……
Name of the Dean or the Director: **Prof. Mahmoud I. Jaghoub**	Signature: ……	Date: ……