Course Specifications

Course Title:	Design and Analysis of Algorithms
Course Code:	ICS 315
Program:	Information and Computer Sciences
Department:	Computer Science and Information
College:	College of Science at Az Zulfi
Institution:	Majmaah university

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A. Course Identification

1. Credit hours: (3) (2 Lec + 2 lab)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 5th level
4. Pre-requisites for this course (if any)**:** Algorithms and Data Structures ICS 223
5. Co-requisites for this course (if any)**: Nil**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	48	80%
2	**Blended**	6	10%
3	**E-learning**	6	10%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60
Other Learning Hours*		
1	**Study**	
2	**Assignments**	
3	**Library**	
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Algorithms are fundamental to computer science and software engineering. The real-world performance of any software system depends on two things: (1) the algorithms chosen, and (2) the suitability and efficiency of the various layers of implementation. Good algorithm design is therefore crucial for the performance of all software systems. Moreover, the study of algorithms provides insight into the intrinsic nature of a problem as well as possible solution techniques independent of programming languages, programming paradigms, computer hardware, and other implementation aspects.

2. Course Main Objective

1. Provide students with the ability to select algorithms appropriate to a particular purpose and to apply them recognizing the possibility that no suitable algorithm may exist.
2. Acquire students with the range of algorithms that address an important set of well-defined problems, recognizing their strengths and weaknesses, and their suitability in particular contexts.
3. Introduce students to a new range of paradigms and techniques to design algorithms and to solve problems.
4. Enable students to be efficient in their work.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recognize the role of algorithms relative to other technologies used in computer science	K1
2	**Skills :**	
2.1	Name the key algorithmic design paradigms including Brute force, Divide and conquer, Decrease and conquer, Transform and conquer, Greedy Algorithms, Dynamic programming	S1
2.2	Determine a language's place in the Chomsky hierarchy (regular, context-free, recursively enumerable).	S2
2.3	Develop, analyze and compare existing algorithms for a wide variety of problems including sorting, searching, graphs, and binary search tree.	S3
2.4	Justify and analyze algorithmic tradeoffs: time vs. space, deterministic vs. randomized, and exact vs. approximate.	S4
3	**Competence:**	
3.1	Write efficient algorithms of certain selected problems.	C1

C. Course Content

No	List of Topics	Contact Hours
1	Basic Definitions: Definition of an algorithm, Time and space tradeoffs in algorithms, Algorithms strategies, Asymptotic analysis of upper and average complexity bounds,	8

	Identifying differences among best, average and worst case behaviors, Big oh, omega, and theta notations.	
2	Brute Force and Exhaustive Search: Selection sort, Bubble sort, Sequential search, Traveling salesman problem, Depth-first search, Breadth-first search.	12
3	Decrease-and-Conquer: Insertion sort, Topological sorting.	8
4	Divide and Conquer: Merge sort, Quicksort and Binary tree traversals.	8
5	Transform and Conquer: heaps and heap sort.	8
6	Dynamic Programming: Optimal Binary search trees and Matrix chain algorithm.	8
7	Greedy Technique: Prim's algorithm, Kruskal's algorithm , Dijkstra's algorithms.	8
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the role of algorithms relative to other technologies used in computer science	Lectures. Lab Case studies. Individual presentations	Written Exam Homework assignments Lab assignments Class Activities Quizzes
2.0	**Skills**		
2.1	Name the key algorithmic design paradigms including Brute force, Divide and conquer, Decrease and conquer, Transform and conquer, Greedy Algorithms, Dynamic programming	Lectures. Lab Case studies. Individual presentations. Brainstorming.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
2.2	Determine a language's place in the Chomsky hierarchy (regular, context-free, recursively enumerable).		
2.3	Develop, analyze and compare existing algorithms for a wide variety of problems including sorting, searching, graphs, and binary search tree.		
2.4	Justify and analyze algorithmic tradeoffs: time vs. space, deterministic vs. randomized, and exact vs. approximate.		
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Write efficient algorithms of certain selected problems.	Lectures. Lab Case studies. Individual group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First written mid-term exam	6	15%
2	Second written mid-term exam	12	15%
3	Presentation, class activities, and group discussion	Every week	10%
4	Homework assignments	After Every chapter	10%
5	Implementation of presented programs	Every two weeks	10%
6	Final written exam	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
Office hours - Office call – Email - Mobile

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Anuj Bhardwaj and Parag Verma, Design and Analysis of Algorithm Hardcover, Alpha Science, 2017.
Essential References Materials	Sandeep Sen, Amit Kumar, Design and Analysis of Algorithms: A Contemporary Perspective 1st Edition, Cambridge University Press, 2019
Electronic Materials	https://www.coursera.org/
Other Learning Materials	Videos and presentations will be available on Blackboard

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom and Lab, as those that are available at college of science at AzZulfi.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart Board - data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	N/A

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
course evaluation	Student-faculty management meeting	Questionnaires
Evaluation of Teaching	Program/Department Instructor	Discussion within the staff members teaching the course Departmental internal review of the course.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	