جامعة المجمعة
Majmaah University

Course Specifications

Institution:	Majmaah University
Academic Department :	Department of Computer Science and Information
Programme :	Computer Science and Information
Course :	Design and Analysis of Algorithms
Course Coordinator :	Assoc. Prof. Hassan Aly
Programme Coordinator :	Assoc. Prof. Yosry Azzam
Course Specification Approved Date :	22/ 12 / 1435 H

A. Course Identification and General Information

1 - Course title : **Design and Analysis of Algorithms**	Course Code: **CSI-321**
2. Credit hours : 3 **credit hours (2 lecture + 2 Exercise)**	
3 - Program(s) in which the course is offered:	**Computer Science and Information Program**
4 – Course Language : **English**	
5 - Name of faculty member responsible for the course:	**Dr. Hassan Aly**
6 - Level/year at which this course is offered :	**6th level**

7 - Pre-requisites for this course (if any) :

- **Data Structures (CSI 312)**

8 - Co-requisites for this course (if any) :

- **N/A**

9 - Location if not on main campus :

College of Science at AzZulfi

10 - Mode of Instruction (mark all that apply)

A - Traditional classroom	√	What percentage?	**80 %**
B - Blended (traditional and online)	√	What percentage?	**10 %**
D - e-learning		What percentage?	**……. %**
E - Correspondence		What percentage?	**……. %**
F - Other	√	What percentage?	**10 %**

Comments :

One-tenth of the course is presented mainly inside video lectures of other instructors worldwide. They illustrate the same topics that I introduced in my lectures with a different presentation.

B Objectives

What is the main purpose for this course?

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.

The purpose of this course is to

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.

Briefly describe any plans for developing and improving the course that are being implemented :

1. Using group discussion using internet with course attending students.
2. Updating the course materials to include the new topics in the field.
3. Increasing the ability of the students to implement the algorithms that are presented in the course.

C. Course Description

1. Topics to be Covered

List of Topics	No. of Weeks	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, Identifying differences among best, average and worst case behaviors, Big oh, omega, and theta notations.	2	8
2. **Solving Recursions:** Using recurrence relations to analyze recursive algorithms, Substitution method, Recursion-tree method, Master theorem method.	2	8
3. **$O(n^2)$ Sorting Algorithms.** Insertion, Selection, Bubble sort.	2	8
4. **Divide and Conquer Paradigm:** Elements of the divide and conquer technique, Merge sort, and Quick sort.	2	8
5. **Searching Algorithms.** Linear and Binary search.	1	4
6. **Graph Algorithms:** Representation of graphs (adjacency list, adjacency matrix), Depth- and Breadth-first traversals. Minimum spanning tree (Kruskal's and Prim's algorithms). Dijkstra's algorithm.	3	12
7. **Advanced data structures:** Binary search tree.	1	4
8. **Dynamic Programming Paradigm:** Elements of dynamic programming, Matrix chain algorithm.	1	4
9. **Greedy Algorithms Paradigm:** Elements of greedy algorithm, optimal binary search tree.	1	4

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	30	30	-	-	-	60
Credit	30	15	-	-	-	45

3. Additional private study/learning hours expected for students per week.

5 **Hours**

The private self-study of my student is crucial for this course. It includes:

- Reading carefully the topics in the textbook or reference book,
- Implementing algorithms using C++ ,
- Browsing the websites related to the course,
- Solving the exercises that are assigned in each chapter,
- Discussing the course topics with the instructor in his office hours,
- Watching the video lectures of other instructors who presented related topics worldwide.

The total workload of the student in this course is then: 60 + 5 x 15 = 135 work hours.

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the role of algorithms relative to other technologies used in computer science.	Lectures, Lab demonstrations, Case studies, Individual presentations	Written Exam, Homework assignments, Lab assignments, Class Activities, Quizzes
1.2	Name the key algorithmic design paradigms including Brute force, Divide and conquer, Decrease and conquer, Transform and conquer, Greedy Algorithms, Dynamic programming.		
1.3	Define the language, notation, and concepts of algorithmic design.		
2.0	**Cognitive Skills**		
2.1	Predict the resources that the algorithm requires.	Lectures, Lab demonstrations, Case studies, Individual presentations, Brainstorming	Written Exam, Homework ,assignments, Lab assignments, Class Activities, Quizzes, Observations
2.2	Develop, analyze and compare existing algorithms for a wide variety of problems including sorting, searching, graphs, and binary search tree.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Justify and analyze algorithmic tradeoffs: time vs. space, deterministic vs. randomized, and exact vs. approximate.	Small group discussions, Whole group discussions, Brainstorming, Presentations	Written Exam, Homework assignments, Lab assignments, Class Activities, Quizzes
3.2	Write efficient algorithms of certain selected problems.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Work cooperatively in a small group environment.	Small group discussions, Whole group discussions, Brainstorming Presentation	Observations, Homework assignments, Lab assignments. Class Activities
4.2	Save time and space in each task.		
5.0	**Psychomotor**		

5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
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 each chapter	10%
5	Implementation of presented algorithms	Every two weeks	10%
6	Final written exam	16	40%
7	Total		100%

D. Student Academic Counseling and Support

Office hours: Sun: 10-12, Mon. 10-12, Wed. 10-12
Office call: Sun. 12-1 and Wed 12-1

Email: h.haly@mu.edu.sa
Mobile: 0538231332

E. Learning Resources

1. List Required Textbooks :

Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein, Introduction to Algorithms, Third Edition. MIT Press, 2009

2. List Essential References Materials :

- **Michael T. Goodrich, Roberto Tamassia, and Divid Mount, Data Structures and Algorithms in C++, John Wiley & Sons Inc, 2011.**
- **Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design & Analysis, Third Edition, 2000.**

3. List Recommended Textbooks and Reference Material :

- **Journal of Algorithms.**

4. List Electronic Materials :

- **http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=3440**
- **http://www-rohan.sdsu.edu/faculty/baase/algortext.html#slideshttp: //en.wikipedia.org/wiki/Genetic_disorders**

5. Other learning material :

- **Video and presentation are available with me**

F. Facilities Required

1. Accommodation

- Classroom and Labe available at College of science in Zulfi.

2. Computing resources

- Smart Board

3. Other resources

- N/A

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching:

- Questionnaires (course evaluation) filled by the students and electronically organized by the university.
- Student-faculty and management meetings.

2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor :

- Discussion within the staff members teaching the course
- Departmental internal review of the course.

3 Processes for Improvement of Teaching :

- Periodical departmental revision of methods of teaching.
- Monitoring of teaching activities by senior faculty members.
- Training courses.

4. Processes for Verifying Standards of Student Achievement

- Reviewing the final exam questions and a sample of the answers of the students by others.
- Visiting the other institutions that introduce the same course one time per semester.
- Watching the videos of other courses by international institutions.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement :

- Course evaluation
- Exam evaluation
- Improvement plan

Course Specification Approved
Department Official Meeting No (6) Date 22 / 12 / 1435 *H*

Course's Coordinator		Department Head	
Name :	Hassan Aly	***Name :***	Dr. Yousry Azzam
Signature :	.....	***Signature :***	.....
Date :	22/12 /1435 *H*	***Date :***	…./ … / …… *H*