National University of Sciences & Technology (NUST)
School of Electrical Engineering and Computer Science (SEECS)
Department of Computing

Design and Analysis of Algorithms

Course Code:	CS 251	**Semester:**	4th
Credit Hours:	3+0	**Prerequisite Codes:**	NA
Instructor:	Sana Khalique	**Class:**	BSCS-6 AB
Office:	Room A-205	**Telephone:**	051-9085-2189
Lecture Days:	Tue, Wed and Friday	**E-mail:**	sana.khalique@seecs.edu.pk
Class Room:	CR 01 and CR 02	**Consulting Hours:**	Tuesday 11:00-13:00
Lab Engineer:	NA	**Lab Engineer Email:**	NA
Knowledge Group:	CS Core	**Updates on LMS:**	Before every lecture

Course Description:

This course introduces students with an understanding of design and analysis of algorithms. Emphasis will be given on the concepts of structure and time complexities of algorithms, so that the students can appreciate the requirements of efficient algorithms. Mathematical and empirical analysis will be used to compare and analyze algorithms. The main focus will be looking at the algorithms from an applied perspective. This includes coding algorithms using efficient data structures, running simulations and comparing results.

Course Objectives:

The learning objectives are:

1. Developing comprehensive knowledge about the fundamental principles, concepts and constructs of algorithms.
2. Developing competencies for the design and analysis of algorithms.

Course Learning Outcomes (CLOs):

		Upon completion of the course, students should demonstrate the ability to:	PLO Mapping**	BT Level*
	CLO 1	Apply algorithmic techniques to deal with given problems	A	C-3
	CLO 2	Choose the appropriate algorithmic design technique for problem solving	B	C-2
	CLO 3	Identify recurrence relation of a given algorithm and solve it.	C	C-1
	CLO 4	Evaluate complexity and correctness of different algorithms	J	C-6

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain
  - *Knowledge(C-1), Comprehension(C-2), Application(C-3), Analysis(C-4), Synthesis(C-5), Evaluation(C-6)*
  - *Perception(P-1), Set(P-2), Guided Response(P-3), Mechanism(P-4), Complete Overt Response(P-5), Adaption(P-6), Organization(P-7)*
  - *Receiving(A-1), Responding(A-2), Valuing(A-3), Organization(A-4), Internalizing(A-5)*

** Description of Program Learning Outcomes (PLOs) is available on website and in a separate document.

Topics to be Covered:

Introduction and overview of Algorithms
Program efficiency and Time Complexity
Recursive Algorithms and Recurrences
Analysis of Sorting Algorithms
Trees
Graph Algorithms
Greedy Algorithms
Dynamic Programming

Lecture Breakdown:	
Week No.	**Topics**
Week 1	Introduction and overview of Algorithms
Week 2	Program efficiency and Time Complexity
Week 3	Recursive Algorithms and Recurrences
Week 4	Analysis of Sorting Algorithms: Insertion Sort, Merge Sort
Week 5	Analysis of Sorting Algorithms: Quick Sort, Radix Sort, Counting Sort
Week 6	**OHT-1**
Week 7	Balanced Trees: Red Black Trees
Week 8	Graph Algorithms Introduction
Week 9	Shortest Path Algorithms: Dijkstra's Algorithm, Bellman Ford, Floyd Warshall
Week 10	Minimum Spanning Trees: Kruskal and Prim's Algorithm
Week 11	Greedy Algorithms: Activity Selection Problem, Huffman Encoding
Week 12	**OHT- 2**
Week 13	Linear Programming
Week 14	String Matching Algorithms
Week 15	Dynamic Programming and Approximation Algorithms
Week 16	Project Presentations
Week 17	Revision
Week 18	**ESE**

Lab Experiments
NA

Tools / Software Requirement:
MS Visual Studio 2013 MS Excel 2013

Books:	
Text Book:	1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. Introduction to Algorithms. 3rd Edition. Publication Date: 2009. MIT Press.
Reference Books:	1. Jon Kleinberg, Eva Tardos. Algorithm Design. 1st Edition. 2006. Pearson Education, Inc.

Course Assessment	
Exam:	2 One Hour Tests (OHT) and 1 End Semester Exam (ESE)
Home work:	3 Assignments minimum
Semester Project:	1 Report for the term/semester project
Quizzes:	4 - 5 Quizzes

Course Assessment Weightages (In accordance with NUST statutes)
• Quizzes: 10%
• Assignments:10%
• OHT-1: 15%
• OHT-2: 15%
• Project: 10%
• End Semester Exam: 40%

Grading Policy:	
Quiz Policy:	The quizzes will be unannounced and normally last for ten minutes. The question framed is to test the concepts involved in last few lectures. Number of quizzes that will be used for evaluation is at the instructor's discretion. Grading for quizzes will be on a fixed scale of 0 to 10. A score of 10 indicates an exceptional attempt towards the answer and a score of 1 indicates your answer is entirely wrong but you made a reasonable effort towards the solution. Scores in between indicate very good (8-9), good (6-7), satisfactory (4-5), and poor (2-3) attempt. Failure to make a reasonable effort to answer a question scores a 0.
Assignment Policy:	In order to develop comprehensive understanding of the subject, assignments will be given. Late assignments will not be accepted / graded. All assignments will count towards the total (No 'best-of' policy). The students are advised to do the assignment themselves. Copying of assignments is highly discouraged and violations will be dealt with severely by referring any occurrences to the disciplinary committee. The questions in the assignment are meant to be challenging to give students confidence and extensive knowledge about the subject matter and enable them to prepare for the exams.
Lab Conduct:	NA
Plagiarism:	SEECS maintains a zero tolerance policy towards plagiarism. While collaboration in this course is highly encouraged, you must ensure that you do not claim other people's work/ ideas as your own. Plagiarism occurs when the words, ideas, assertions, theories, figures, images, programming codes of others are presented as your own work. You must cite and acknowledge all sources of information in your assignments. Failing to comply with the SEECS plagiarism policy will lead to strict penalties including zero marks in assignments and referral to the academic coordination office for disciplinary action.