UNIVERSITY OF SARGODHA

DEPARTMENT OF

COURSE OUTLINE Spring 2020

Course Title: Design and Analysis of Algorithm

Course Code: **CS-3143**

Credit Hours:3

Course Structure: Lectures: 3 / Labs: 0

Prerequisites: CMP-2111 (Discrete Structure)

Course Objectives: The course introduces students with the basic notions of the design of algorithms and the underlying data structures. Students will learn about several measures regarding the structure, complexity, and efficiency of algorithms.

Instructor: **Nisar Ahmad**

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COURSE SCHEDULE

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| Week | Topics and Readings |
| 1. | Role of Algorithms in Computing, Analysing Algorithms, Designing Algorithms, Growth of Functions, Asymptotic Notation, Standard Notations and Common Functions. [TB: Ch1,2,3] |
| 2. | Divide-and-Conquer, Strassen‘s Algorithm for Matrix Multiplication, Recursion. [TB: Ch. 4] |
| 3. | Recurrences: Substitution Method for Solving Recurrences, Recursion-Tree Method for Solving Recurrences, Master Method for Solving Recurrences. [TB: Ch. 4 |
| 4. | Sorting and Order Statistics: Heapsort Algorithm, Priority Ques, Quicksort Algorithm, Analysis of Quicksort. [TB: Ch. 6, 7] |
| 5. | Sorting in Linear Time: Lower Bounds for Sorting, Counting Sort, Radix Sort, Bucket Sort. [TB: Ch. 8] |
| 6. | Medians and Order Statistics, Binary Search Trees, Querying a Binary Search Tree, Insertion and Deletion. [TB: Ch. 9, 12] |
| 7. | Red-Black Trees: Properties of Red-Black Trees, Rotations, Insertion, Deletion; Minimum Spanning Trees: Introduction, Growing a Minimum Spanning Tree. [TB: Ch. 12 |
| 8. | Dynamic Programming: Elements of Dynamic Programming, Longest Common Subsequence, Optimal Binary Search Trees [TB: Ch. 15] |
| 9. | Greedy Algorithms: Elements of The Greedy Strategy, Huffman Codes, Matroids and Greedy Methods, Task-Scheduling Problem. [TB: Ch. 16] |
| 10. | Elementary Graph Algorithms, Representations of Graphs, Breadth-First Search, Depth First Search, Topological Sort. [TB: Ch. 22] |
| 11. | Single-Source Shortest Paths: The Bellman-Ford Algorithm, Single-Source Shortest Paths in Directed Acyclic Graphs, Dijkstra‘s Algorithm. [TB: Ch. 24 |
| 12. | All-Pairs Shortest Paths: Floyd-Warshall Algorithm, Johnson‘s Algorithm for Sparse Graphs. [TB: Ch. 25] |
| 13. | . Maximum Flow: Flow Networks, Ford-Fulkerson Method, Push-Relabel Algorithms, Relabel-to-Front Algorithm. [TB: Ch. 26] |
| 14. | String Matching: Naive String-Matching Algorithm, Rabin-Karp Algorithm, String Matching with Finite Automata, Knuth-Morris-Pratt Algorithm. [TB: Ch. 32] |
| 15. |  |
| 16. |  |

**Text Book(s):**  Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, The MIT Press; 3rdEdition (2009). ISBN-10: 0262033844

**Reference Material:**  Introduction to the Design and Analysis of Algorithms by Anany Levitin, Addison Wesley; 2ndEdition (2006). ISBN-10: 0321358287  Algorithms in C++ by Robert Sedgewick (1999). ASIN: B006UR4BJS  Algorithms in Java by Robert Sedgewick, Addison-Wesley Professional; 3rdEdition(2002). ISBN-10: 0201361205

Labs

Lab work should be carried out to develop students‘Computer Skills, Operating Systems and Utility Software Skills, E-Mail Skills, Word Processing Skills, Spreadsheet Skills, Electronic Presentation Skills, Web Surfing Skills.

ASSESSMENT CRITERIA

Sessional: 20 [QUIZES +ASSIGNMENTS]

Mid term: 30

Final exam:50

RULES AND REGULATIONS

* **Class Attendance and Absenteeism**

Students are required to attend all classes and lab meetings. Regular attendance in their class/laboratory sessions will be very helpful to maintain a satisfactory progress throughout their course. Attendance will be strictly enforced and evaluated according to the Student Attendance Control Criteria announced by the DOCSIT and UoS. Any student who exceeds the maximum allowable absence limit during the course will not be allowed to sit in the exams. The maximum allowed limit for this course is 25% which include both excused and unexcused absences.

* **Policy on Late Lab. / Project Report and Written Work =============**

Assignments are due at the beginning of the class on the date indicated in the course schedule or on the assignment.  If the due date is extended, you will be informed of this through notice board. Assignments will not be accepted after the classroom discussion occurs. Such discussion would provide an unfair advantage to those who are preparing/submitting the assignment after the fact. At the instructor's option, late assignments may be evaluated to provide feedback, but WILL NOT BE GRADED. Late assignments will receive a grade of zero.

* **Academic Integrity**

Cheating in any form will not be tolerated and could lead to severe consequences. Academic work submitted by the students in the form of homework, assignment, or a project must be the result of their own effort.

* **Make-Up Exam Policy**

A student who has missed an exam will be allowed to sit in a make-up exam only if he or she provides a medical report from a government hospital/clinic.

* **General Behavior**

Students must maintain a good behavior both in and outside their classes. They are required to keep their mobile phones switched off while attending their class/laboratory sessions or writing their exams. Any student who engages in a behavior that disrupts the learning environment may face disciplinary action under the UoS code. Students must also maintain a smoke free environment in all college facilities.