University of Asia Pacific (UAP)
Department of Computer Science and Engineering (CSE)

Course Outline

Program:	Computer Science and Engineering (CSE)
Course Title:	Algorithm Lab
Course Code:	CSE 208
Semester:	Fall- 2021
Level:	4th Semester
Credit Hour:	1.5
Name & Designation of Teacher:	Tanjina Helaly, Assistant Professor Fahad Ahmed, Lecturer
Office/Room:	7th Floor
Class Hours:	**Sunday** 8:00am-10:50 AM (B2) **Wednesday** 8:00am-10:50 AM (B1), **Wednesday** 11:00am-1:50 PM (A2)
Consultation Hours:	**Lab Hour**
E-mail:	fahadahmed@uap-bd.edu
Mobile:	**01737777912**
Rationale:	Algorithm Lab course is required for the student to be able to design, develop and analyze algorithms to solve real life problems. This is a required course and a prerequisite to Theory of Computation (CSE 307), Mathematics for Computer Science (CSE 401), and Artificial Intelligence and Expert Systems (CSE 403) in the CSE program
Prerequisite (if any)**:**	None
Course Synopsis:	**Complexity analysis**: Growth of function, asymptotic notations, orders, designing worst case and average-case. **Recurrence relations:** Substitution method, iteration method, master method. Divide and Conquer Algorithm. Dynamic Programming: Elements of Dynamic Programming, Optimal binary search tree, 0/1 Knapsack problem. Greedy Method: Elements of greedy method, basic control structure, Application of Greedy method in: Minimum cost spanning tree, Huffman code. Backtracking:

Basic idea behind backtracking, control structure. Application of backtracking in: graph coloring problem, n -queens problems. Graph related algorithms: Breadth First search, Depth First search, Dijkstra's shortest path algorithm, The Bellman-Ford algorithm for single source shortest path, The Floyd-War shall algorithm for all pair shortest path, Number theory algorithms: Factorization problem, discrete logarithm problem, NP- Completeness: Polynomial time, polynomial time verification, NP complete problems. Approximation Algorithms: Introduction, the vertex-cover problem, the traveling-salesman problem, the subset-sum problem.

Course Objectives (CO):

The objectives of this course are to:

1. **Enable** students to analyze and solve a problem using appropriate algorithms.
2. **Teach** algorithmic complexity and compare between algorithms.
3. **Demonstrate** how to use a modern IDE to implement algorithms.

Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CO1	**Explain** terms related to basic algorithm, algorithm analysis, and design techniques/paradigm.	1	1/Understand	Live/ Recorded Video Lectures, PPT presentation, self-study	Written online Quiz/short question using Google form, Viva
CO2	**Solve** practical problems applying the algorithm techniques/paradigms and appropriate data structures.	3	1/Analyze	Live/ Recorded Video Lectures, self-study	Coding problems followed by viva
CO3	**Analyze** the performance / resource requirements of various algorithms.	4	1/Apply	Live/ Recorded Video Lectures, self-study	Coding problems followed by viva

Weighting COs with Assessment methods:

Assessment Type	% weight	CO1	CO2	CO3
Lab final (Codding Efficiency) (Sessional final)	30		30	
Lab final Viva (Viva)	10	10		
Mid Term Evaluation (Quiz)	20	10	5	5
Continuous Evaluation (30) + Assignment (10) (Assessment)	40		40	
	10	**20**	**75**	**5**

Course Content Outline and mapping with COs

Weeks	Topics / Content	Course Outcome	Delivery methods and activities	Reading Materials
1	Analyzing Algorithms: Introduction, Worst-Case and Best-Case Analysis, Asymptotic notation.	CO1	Live/ Recorded Video Lectures, PPT presentation	Slides, Books, reference links
2	Analyzing Algorithms: Time and space complexity.	CO1	Live/ Recorded Video Lectures, PPT presentation	Slides, Books, reference links
3-4	The Divide-and-Conquer Approach; Analyzing Divide-and-Conquer Algorithms Binary search, merge sort	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
5	Greedy algorithm: Coin change, fractional knapsack.	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
6	Dynamic Programming Basics: Recursion	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
7-9	Dynamic Programming : Coin changing problem , Subset sum, 0/1 Knapsack Problem, Longest Common Subsequence , Elements of Dynamic Programming	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
10	Backtracking: The Knight's tour problem, Rat in a Maze, Subset Sum, m Coloring Problem	CO1, CO2,, CO3	Live/ Recorded Video Lectures, PPT presentation,	Slides, Books, reference links

11	Graph Theory. Applications of Graph Traversal Algorithms (DFS and BFS)	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
12-13	Disjoint-Set Operations; Minimum Spanning Tree: Single-Source Shortest Path Variants, Negative-weight Edges, Cycles, Relaxation ,The Bellman-Ford Algorithm ,Dijkstra's Algorithm	CO1, CO2, CO3	Live/ Recorded Video Lectures, PPT presentation, self-study	Slides, Books, reference links
14	**Final Exam + Viva**			

Minimum attendance: 70% class attendance is mandatory for a student in order to appear at the final examination.

Textbook: T.H. Cormen, C.E.Leiserson, R. L. Rivest, C. Stein: *Introduction to Algorithms*, Third Edition, 2009, PHI Learning Pvt. Ltd

Recommended References:
1. Doanld E. Knuth : *Fundamental Algorithms (vol-1) (The Art of Computer Programming)*, Third edition, 1997, Addison-Wesley Professional
2. Ellis Horowitz & Sartaj Sahni*: Fundamental of Computer Algorithms*, First Edition, 1983, Springer
3. **https://www.geeksforgeeks.org/fundamentals-of-algorithms/**

Grading System: As per the approved grading scale of University of Asia Pacific (Appendix-3).

Special Instructions: **Late attendance:** Students who will enter the class after the attendance call will be marked as absent.
Assignment: **Unfinished** work should be submitted as assignment. **Additional** assignments may be given as needed. Copied homework will be graded as zero. Late submission will result in a 50% deduction in score.

Student's responsibilities: Students must come to the class prepared for the course material covered in the previous class (es).
They must submit their assignments on time.

Prepared by (Course Teacher)	Checked by (Chairman, PSAC committee)	Approved by (Head of the Department)
Dr. Nasima Begum Dr. Muhammad Towfiqur Rahman		

Appendix-1:

Washington Accord Program Outcomes (PO) for engineering programs:

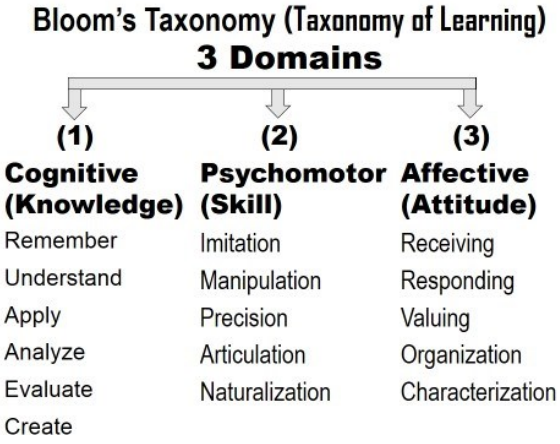
No.	PO	Differentiating Characteristic
1	Engineering Knowledge	Breadth and depth of education and type of knowledge, both theoretical and practical
2	Problem Analysis	Complexity of analysis
3	Design/ development of solutions	Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
4	Investigation	Breadth and depth of investigation and experimentation
5	Modern Tool Usage	Level of understanding of the appropriateness of the tool
6	The Engineer and Society	Level of knowledge and responsibility
7	Environment and Sustainability	Type of solutions.
8	Ethics	Understanding and level of practice
9	Individual and Team work	Role in and diversity of team
10	Communication	Level of communication according to type of activities performed
11	Project Management and Finance	Level of management required for differing types of activity
12	Lifelong learning	Preparation for and depth of Continuing learning.

Generic Skills (Detailed):

1. **Engineering Knowledge (T)** -Apply knowledge of mathematics, sciences, engineering fundamentals and manufacturing engineering to the solution of complex engineering problems;
2. **Problem Analysis (T)** – Identify, formulate, research relevant literature and analyze complex engineering problems, and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
3. **Design/Development of Solutions (A)** –Design solutions, exhibiting innovativeness, for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, economical, ethical, environmental and sustainability issues.
4. **Investigation (D)** Conduct investigation into complex problems, displaying creativeness, using research-based knowledge, and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
5. **Modern Tool Usage (A & D)** -Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations;

6. **The Engineer and Society (ESSE)** -Apply reasoning based on contextual knowledge to assess societal, health, safety, legal, cultural, contemporary issues, and the consequent responsibilities relevant to professional engineering practices.
7. **Environment and Sustainability (ESSE)** -Understand the impact of professional engineering solutions in societal, global, and environmental contexts and demonstrate knowledge of and need for sustainable development;
8. **Ethics (ESSE)** –Apply professional ethics with Islamic values and commit to responsibilities and norms of professional engineering code of practices.
9. **Communication (S)** -Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;
10. **Individual and Team Work (S)** -Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
11. **Lifelong Learning (S)** -Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
12. **Project Management and Finance (S)** -Demonstrate knowledge and understanding of engineering management and financial principles and apply these to one's own work, as a member and/or leader in a team, to manage projects in multidisciplinary settings, and identify opportunities of entrepreneurship.

Appendix-2



Appendix-3

UAP Grading Policy:

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00