Lovely Professional University, Punjab

Course Code	Course Title	Lectures	Tutorials	Practicals	Credits	
CSE408	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3	
Course Weightage	ATT: 5 CA: 25 MTT: 20 ETT: 50					

Course Focus	EMPLOYABILITY,SKILL DEVELOPMENT

Course Outcomes :Through this course students should be able to

CO1 :: Understand the basic techniques of analyzing the algorithms using space and time complexity, asymptotic notations

CO2 :: apply the various string matching algorithms

CO3 :: Analyze the divide and conquer algorithm design technique using various problems

CO4 :: Evaluate the various dynamic programming and greedy algorithm design technique to solve various problems

CO5 :: Apply the Approximation Algorithm to solve some classic problems and design technique.

CO6 :: Define intractability (NP-completeness) and understand to solve the optimization problems

It is mandatory to complete the number of courses for being eligible for End Term Examination along with the attendance criteria of the university. The links of the courses as shared in the IP should be completed on/before the last teaching day as per the academic calendar of the university.

Relevant Websites (RW)

Sr No	(Web address) (only if relevant to the course)	Salient Features
RW-1	https://www.coursera.org/learn/analysis-of-algorithms	Foundations of Algorithm
RW-2	https://www.coursera.org/learn/algorithms-on-strings	String and its Matching Algorithms
RW-3	www.coursera.org/learn/linear-programming-and-approximation-algorithms	Introduction to Approximation Algorithms
RW-4	https://www.coursera.org/learn/dynamic-programming-greedy-algorithms	Divide and Conquer,Dynamic Programming ,Greedy Algoritms, NP completeness

LTP week distribution: (LTP Weeks)

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Weeks before MTE	7
Weeks After MTE	7
Spill Over (Lecture)	7

Detailed Plan For Lectures

Week Number	Tentative Date	Broad Topic	Sub Topics	Link of Sub Topics
Week 1	10/1/2024-16/1/2024	Foundations of Algorithm	**Analysis of Algorithms**	
	10/1/2024-16/1/2024		1. History and Motivation	1.https://www.coursera.org/learn/analysis-of-algorithms/lecture/oiAWW/history-and-motivation
	10/1/2024-16/1/2024		2. A Scientific Approach	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/LAXjA/a-scientific-approach
	10/1/2024-16/1/2024		3. Example: Quicksort	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/36aPp/example-quicksort
	10/1/2024-16/1/2024	Foundations of Algorithm	**Recurrences**	
	10/1/2024-16/1/2024		1. Computing Values	1.https://www.coursera.org/learn/analysis-of-algorithms/lecture/u28LG/computing-values
	10/1/2024-16/1/2024			
	10/1/2024-16/1/2024		2. Telescoping	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/43guA/telescoping
	10/1/2024-16/1/2024		3. Types of Recurrences	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/XddoK/types-of-recurrences
	10/1/2024-16/1/2024		4. Mergesort	4. https://www.coursera.org/learn/analysis-of-algorithms/lecture/tMV3b/mergesort
	10/1/2024-16/1/2024		5. Master Theorem	5. https://www.coursera.org/learn/analysis-of-algorithms/lecture/PMROV/master-theorem
Week 2	17/1/2024-23/1/2024	Foundations of Algorithm	**Generating functions**	
	17/1/2024-23/1/2024		1. Ordinary Generating Functions,	1. https://www.coursera.org/learn/analysis-of-algorithms/lecture/RqDLx/ordinary-generating-functions
	17/1/2024-23/1/2024		2. Counting with Generating Functions,	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/b0Spr/counting-with-generating-functions
	17/1/2024-23/1/2024		3. Catalan Numbers,	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/EcHFd/catalan-numbers

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	17/1/2024-23/1/2024		4. Solving Recurrences,	4. https://www.coursera.org/learn/analysis-of-algorithms/lecture/tnmBd/solving-recurrences
	17/1/2024-23/1/2024		5. Exponential Generating Functions.	5. https://www.coursera.org/learn/analysis-of-algorithms/lecture/WpbNx/exponential-generating-functions
Week 3	24/1/2014-30/1/2024	Foundations of Algorithm	**Asymptotics**	
	24/1/2014-30/1/2024		1.Standard Scale	1. https://www.coursera.org/learn/analysis-of-algorithms/lecture/0IJDV/standard-scale
	24/1/2014-30/1/2024		2.Manipulating Expansions	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/j8EnC/manipulating-expansions
	24/1/2014-30/1/2024		3.Asymptotic of Finite Sums	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/vradC/asymptotics-of-finite-sums
	24/1/2014-30/1/2024		4. Bivariate Asymptotics	4. https://www.coursera.org/learn/analysis-of-algorithms/lecture/OHrli/bivariate-asymptotics
	24/1/2014-30/1/2024	Foundations of Algorithm	**Trees**	
	24/1/2014-30/1/2024		1. Trees and Forests	1. https://www.coursera.org/learn/analysis-of-algorithms/lecture/feztA/trees-and-forests
	24/1/2014-30/1/2024		2. Binary Search Trees	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/IXKQw/binary-search-trees
	24/1/2014-30/1/2024		3. Path Length	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/Bzppb/path-length
	24/1/2014-30/1/2024		4. Other Types of Trees.	4. https://www.coursera.org/learn/analysis-of-algorithms/lecture/Je4Cj/other-types-of-trees
Week 4	31/1/2024-6/2/2024	String and its Matching Algorithms	**Strings and Tries**	
	31/1/2024-6/2/2024		1. Bit strings with Restrictions	1. https://www.coursera.org/learn/analysis-of-algorithms/lecture/eASyM/bitstrings-with-restrictions
	31/1/2024-6/2/2024		2. Languages	2. https://www.coursera.org/learn/analysis-of-algorithms/lecture/EYuD7/languages
	31/1/2024-6/2/2024		3. Tries	3. https://www.coursera.org/learn/analysis-of-algorithms/lecture/5iqb3/tries
	31/1/2024-6/2/2024		4. Trie Parameters	4. https://www.coursera.org/learn/analysis-of-algorithms/lecture/rrWLr/trie-parameters

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	31/1/2024-6/2/2024		**Key pattern matching concepts:**	
	31/1/2024-6/2/2024		1. Suffix Tree	1. https://www.coursera.org/learn/algorithms-on-strings/home/week/1
	31/1/2024-6/2/2024		2. Knuth-Morris-Pratt algorithm	2. https://www.coursera.org/learn/algorithms-on-strings/home/week/3
week5	7/2/2024-13/2/2024		TEST1	
	7/2/2024-13/2/2024	Divide and Conquer Technique	**Divide and Conquer Technique**	https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/supplement/uYVoZ/overview-of-module-1
	7/2/2024-13/2/2024		1.What Are Divide and Conquer Algorithms?	1. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/WDlY3/what-are-divide-and-conquer-algorithms
	7/2/2024-13/2/2024		2.Max Subarray Problem Using Divide and Conque	2.https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/zZxvL/max-subarray-problem-using-divide-and-conquer
	7/2/2024-13/2/2024		3. .Karatsuba's Multiplication Algorithm ,	3. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/eYkEq/karatsubas-multiplication-algorithm
Week 6	14/2/2024-20/2/2024	Divide and Conquer Technique	1. FFT Part 1: Introduction and Complex Numbers,FFT	1. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/UErFb/fft-part-1-introduction-and-complex-numbers
	14/2/2024-20/2/2024		2. Definition and Interpretation of Discrete Fourier Transforms, FFT:	2. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/mSmQQ/fft-part-2-definition-and-interpretation-of-discrete-fourier-transforms
	14/2/2024-20/2/2024		3. Divide and Conquer Algorithm for FFT,	3. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/DD0H5/fft-part-3-divide-and-conquer-algorithm-for-fft
	14/2/2024-20/2/2024		4. Application # 1 : Fast Polynomial Multiplication using FFT ,	4. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/vkC5d/application-1-fast-polynomial-multiplication-using-fft

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	14/2/2024-20/2/2024		5. Application # 2: Data Analysis using FFT)	5. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/skosc/application-2-data-analysis-using-fft
Week 7	21/2/2024-27/2/2024		**TEST 2**	
		Lecture 20		
		Lecture 21		
MTE				
Week 8	14/02/2024-20/02/2024	Dynamic Programming and Greedy Techniques	**Dynamic Programming and Greedy Techniques**	https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/supplement/wOGMy/overview-of-module-2
	14/02/2024-20/02/2024		1. Introduction to Dynamic Programming + Rod Cutting Problem	1. . https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/6E9rT/introduction-to-dynamic-programming-rod-cutting-problem
	14/02/2024-20/02/2024		2. Rod Cutting Problem: Memoization	2. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/7UsUu/rod-cutting-problem-memoization
	14/02/2024-20/02/2024		3. Coin Changing Problem	3. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/1ymc9/coin-changing-problem
	14/02/2024-20/02/2024		4. Knapsack Problem	4. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/ev4NL/knapsack-problem
Week 9	21/02/2024-27/02/2024	Dynamic Programming and Greedy Techniques	1. When Optimal Substructure Fails	1. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/7U6eq/when-optimal-substructure-fails
	21/02/2024-27/02/2024		2.Dynamic Programming: Longest Common Subsequence	2. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/H3XVF/dynamic-programming-longest-common-subsequence
	21/02/2024-27/02/2024		**Greedy Algorithms**	1.https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/supplement/07H2P/overview-of-module-3

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	21/02/2024-27/02/2024		2. Introduction to Greedy Algorithm	2. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/x57tt/introduction-to-greedy-algorithms
	21/02/2024-27/02/2024		3. Greedy Interval Scheduling	3. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/N5OjG/greedy-interval-scheduling
	21/02/2024-27/02/2024		4. Prefix Codes	4. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/acxZW/prefix-codes
	21/02/2024-27/02/2024		5. Huffman Codes	5.https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/n381c/huffman-codes
	21/02/2024-27/02/2024		6. Huffman Codes: Proof of Optimality	6 https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/bQW95/huffman-codes-proof-of-optimality
Week 10	28/02/2024-03/04/2024	Approximation Algorithms	**Approximation Algorithms:Scheduling,Vertex Cover and MAX-SAT**	_
	28/02/2024-03/04/2024		1. Introduction to Approximation Algorithms	1. https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/cRczb/introduction-to-approximation-algorithms
	28/02/2024-03/04/2024		2. Introduction to Jobshop Scheduling and Algorithm design	2. https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/X9s0L/introduction-to-jobshop-scheduling-and-algorithm-design

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	28/02/2024-03/04/2024		3. Analysis of Jobshop Scheduling	3. https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/EukmR/analysis-of-jobshop-scheduling
Week 11	04/04/2024-10/04/2024	Approximation Algorithms	1. Approximation Algorithms for Vertex Cover and their Analysis	1. https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/Ii8kJ/approximation-algorithms-for-vertex-cover-and-their-analysis
	04/04/2024-10/04/2024		2. Approximation Algorithms for the Maximum Satisfiability Problem	2. https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/59sPO/approximation-algorithms-for-the-maximum-satisfiability-problem
Week 12	11/04/2024-17/04/2024	Approximation Algorithms	**Travelling Salesman Problem and Approximation schemes**	_
	11/04/2024-17/04/2024		1.Introduction to TSP and its applications	1.https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/e0BRo/introduction-to-tsp-and-its-applications

	11/04/2024-17/04/2024		2. NP-Hardness of TSPs	2.https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/7aOFO/np-hardness-of-tsps
	11/04/2024-17/04/2024		3. Hardness of Approximating General TSPs	3.https://www.coursera.org/learn/linear-programming-and-approximation-algorithms/lecture/kHKKa/hardness-of-approximating-general-tsps
Week 13	18/04/2024-24/04/2024	Introduction to intractability (NP-completeness) and solving optimization problems	**Intractability and supplement on Quantum Computing**	_
	18/04/2024-24/04/2024		.1.Decision Problems and Languages,	1. https://www.coursera.org/lecture/dynamic-programming-greedy-algorithms/decision-problems-and-languages-1Ngm0
	18/04/2024-24/04/2024		2. Polynomial Time Problmes	2. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/sgyBD/polynomial-time-problems
	18/04/2024-24/04/2024		3. NP Definition,	3. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/QBI2s/np-definition
	18/04/2024-24/04/2024		4. NP Completeness and Reductions	4. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/FX8p4/np-completeness-and-reductions

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			5.,NP Complete Problems: Examples,	5. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/HZV05/np-complete-problems-examples
	18/04/2024-24/04/2024			
	18/04/2024-24/04/2024		6. Computation and Physics ,	6. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/xsbpd/computation-and-physics
	18/04/2024-24/04/2024		7.Qubits and Operations,	7. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/bzesh/qubits-and-operations
	18/04/2024-24/04/2024		8. Bell's Inequality,	8. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/nRWD3/bells-inequality
	18/04/2024-24/04/2024		9.Grover's Search Algorithm	9. https://www.coursera.org/learn/dynamic-programming-greedy-algorithms/lecture/PJoyZ/grovers-search-algorithm
Week 14	25/4/2024-01/05/2024	Lecture 40	**TEST3**	
	25/4/2024-01/05/2024	Lecture 41		
	25/4/2024-01/05/2024	Lecture 42		

Scheme for CA:

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CA Category of this Course Code is:A0203 (2 best out of 3)

Component	Weightage (%)	Mapped CO(s)
Test 1	50	CO1, CO2
Test 2	50	CO3
Test 3	50	CO4, CO5, CO6

Details of Academic Task(s)

Academic Task	Objective	Detail of Academic Task	Nature of Academic Task (group/individuals)	Academic Task Mode	Marks	Allottment / submission Week
Test 1	To check the learning level	MCQ Based Class Test	Individual	Online	30	5 / 5
Test 2	To Check the Learning level	MCQ based Class Test	Individual	Online	30	7 / 7
Test 3	To check the learning level	MCQ Based Class Test	Individual	Online	30	13 / 14

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