

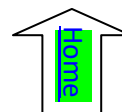
Savitribai Phule Pune University

Fourth Year of Computer Engineering (2019 Course)

410241: Design and Analysis of Algorithms

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
Prerequisites Courses: Discrete Mathematics (210241), Fundamentals of Data Structures(210242, Data Structures and Algorithms(210252), Theory of Computation (310242)		
Companion Course: Laboratory Practice III(410246)		
Course Objectives: <ul style="list-style-type: none"> • To develop problem solving abilities using mathematical theories. • To apply algorithmic strategies while solving problems. • To analyze performance of different algorithmic strategies in terms of time and space. • To develop time and space efficient algorithms. • To study algorithmic examples in distributed and concurrent environments • To Understand Multithreaded and Distributed Algorithms 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> CO1: Formulate the problem CO2: Analyze the asymptotic performance of algorithms CO3: Decide and apply algorithmic strategies to solve given problem CO4: Find optimal solution by applying various methods CO5: Analyze and Apply Scheduling and Sorting Algorithms. CO6: Solve problems for multi-core or distributed or concurrent environments 		
Course Contents		
Unit I	Algorithms and Problem Solving	07 Hours
Algorithm: The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample examples, Iterative algorithm design issues. Problem solving Principles: Classification of problem, problem solving strategies, classification of time complexities (linear, logarithmic etc.)		
#Exemplar/Case Studies	Towers of Hanoi	
*Mapping of Course Outcomes for Unit I	CO1,CO3	
Unit II	Analysis of Algorithms and Complexity Theory	07 Hours
Analysis: Input size, best case, worst case, average case Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω , Θ , o and ω notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle.		
#Exemplar/Case Studies	Analysis of iterative and recursive algorithm	

*Mapping of Course Outcomes for Unit II	CO2
Unit III	Greedy And Dynamic Programming algorithmic Strate 08 Hours
<p>Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problem.</p> <p>Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix multiplication.</p>	
#Exemplar/Case Studies	Rail tracks connecting all the cities
*Mapping of Course Outcomes for Unit III	CO3, CO4
Unit IV	Backtracking and Branch-n-Bound 08 Hours
<p>Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem.</p> <p>Branch-n-Bound: Principle, control abstraction, time analysis of control abstraction, strategies- FIFO, LIFO and LC approaches, TSP, knapsack problem.</p>	
#Exemplar/Case Studies	Airline Crew Scheduling
*Mapping of Course Outcomes for Unit IV	CO3, CO4
Unit V	Amortized Analysis 07 Hours
<p>Amortized Analysis: Aggregate Analysis, Accounting Method, Potential Function method, Amortized analysis-binary counter, stack Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems.</p>	
#Exemplar/Case Studies	cutting stock problem
*Mapping of Course Outcomes for Unit V	CO3, CO5
Unit VI	Multithreaded And Distributed Algorithms 07 Hours
<p>Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms, Parallel loops, Race conditions.</p> <p>Problem Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreaded merge sort.</p> <p>Distributed Algorithms - Introduction, Distributed breadth first search, Distributed Minimum Spanning Tree.</p> <p>String Matching- Introduction, The Naive string matching algorithm, The Rabin-Karp algorithm.</p>	
#Exemplar/Case Studies	Plagiarism detection



***Mapping of Course
Outcomes for UnitVI**

CO6

Learning Resources

Text Books:

1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, “Design And Analysis of Algorithms”, Pearson Education, ISBN 81-7758-595-9
2. Gilles Brassard, Paul Bratley, “Fundamentals of Algorithmics”, PHI, ISBN 978-81-203-1131-2

Reference Books :

1. Michael T. Goodrich, Roberto Tamassia, “Algorithm Design: Foundations,” Analysis and Internet Examples, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 817371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, “Randomized Algorithms” Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, “Algorithms on Strings, Trees and Sequences”, Cambridge University Press, ISBN: 0-521-67035-7

e-Books :

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf
2. <https://www.ebooks.com/en-in/book/1679384/algorithms-design-techniques-and-analysis/m-h-alsuwaiyel>

MOOC Courses links :

- Design and Analysis of Algorithms - <https://nptel.ac.in/courses/106106131>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	-	-	-	-	-	-	-	-	3
CO4	2	3	3	2	-	-	-	-	-	-	-	3
CO5	2	2	2	2	-	-	-	-	-	-	-	3
CO6	2	2	1	2	-	-	-	-	-	-	-	-