UE18CS311: ADVANCED ALGORITHMS (4-0-0-0-4)

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# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Syllabus	
	Unit I.:	**Basics of Complexity:**	**21.43**	**21.43**
1	**T1: Chapter 3 3.1**	Asymptotic Notations- Basic operation, time analysis		
2	**3.1**	Asymptotic Notations-Big O, Big Omega, Big Theta, Little o, Little omega		
3	**3.2**	Standard functions and common functions		
4	**T1:4.3**	Recurrence Relations		
5	**4.3**	Substitution Method		
6	**4.4**	Recurrence Tree method		
7	**4.5**	The Master method		
8	**T1: 17.1**	Amortized Complexity Analysis		
9	**17.1,17.2, 17.3**	Aggregate, Accounting and Potential Methods: Stack, Binary Counter		
10	**17.4**	Aggregate, Accounting and Potential Methods: Dynamic Array		
11	**T1: 34.1, 34.3**	NP-Completeness		
12	**34.3**	NP Reduction		
	Unit II:	**String Algorithms**		
13	**T1- 32.1**	Naïve String Match	**17.85**	**39.28**
14	**R1:18.3**	Boyer–Moore		
15	**R1:18.3**	Boyer–Moore		
16	**T1:32.2**	Rabin–Karp		
17	**32.3**	String matching with Finite State Automata		
18	**32.4**	Knuth–Morris–Pratt Algorithm		
19	**32.4**	Knuth–Morris–Pratt Algorithm		
20	**R1:12.3**	Suffix Trees		

21	**R1:12.3**	Applications of Suffix Trees		
22	**R1:12.3**	Regular Expression Searches Using Suffix Trees.		
	Unit III:	**Maximum Flow, Polynomials and FFT**:		
23	**T1: 26.1**	Flow Networks: Max Flow	**21.43**	**60.71**
24	**26.1**	Max Flow – Min Cut Theorem		
25	**26.2**	The Ford-Fulkerson method		
26	**26.2**	The Edmonds-Karp algorithm		
27	**26.3**	Maximum Bi-Partite Matching		
28	**26.3**	Maximum Bi-Partite Matching		
29	**T1:30.1**	Polynomials and FFT: Representation of Polynomials		
30	**30.1**	Polynomials and FFT: Representation of Polynomials		
31	**30.1**	Efficient Polynomial Multiplication		
32	**30.2**	DFT		
33	**30.2**	FFT		
34	**30.3**	Efficient Implementation of FFT		
	Unit IV:	**Number-Theoretic Algorithms**:		
35	**T1: 31.1**	Elementary notions	**17.85**	**78.57**
36	**31.2**	GCD, Modular Arithmetic		
37	**31.3**	Solving modular linear equations		
38	**31.3**	Solving modular linear equations		
39	**31.4**	Modular Inverse		
40	**31.5**	The Chinese remainder theorem		
41	**31.6**	Powers of an element		
42	**31.7**	RSA cryptosystem		
43	**31.8**	Primality testing		
44	**31.9**	Integer factorization		

	Unit V.	**Dynamic Programming, Randomized Algorithms and Approximation Algorithms**		
45	**T1: 15.1**	Elements of Dynamic Programming	**21.43**	**100**
46	**15.1**	Dynamic Programming, Problems - Coin-Row		
47	**15.1**	Dynamic Programming, Problems - Rod-Cutting		
48	**15.2**	Dynamic Programming, Problems Matrix-Chain Multiplication		
49	**15.4**	Dynamic Programming, Problems: Longest Common Subsequence		
50	**T1: 5.1**	Randomized Algorithms: Introduction		
51	**5.1**	Randomized Algorithms: Hiring Problem		
52	**5.2**	Indicator random variables		
53	**T1: 35.1**	Approximation Algorithm: Vertex Cover Problem		
54	**35.2**	Approximation Algorithm: TSP		
55	**35.3**	Approximation Algorithm: Subset Sum Problem		
56	**35.4**	Randomization and Linear Programming		

Book Type	**Code**	**Title & Author**	**Publication Information**		
			Edition	**Publisher**	**Year**
Text Books	T1	"Introduction to Algorithms", T H Cormen, C E Leiserson, R L Rivest and C Stein	3	PHI	2010
Reference Book	R1	"The Algorithm Manual", Steven Skiena	2	Springer	
	R2	"Randomized Algorithms", R Motwani and P Raghavan		Cambridge University Press	2011