

CS202

AUTOMATA AND FORMAL LANGUAGES

1. **Finite Automata** - Deterministic, non-deterministic and equivalence - Equivalence of regular expressions and FA - Moore and Mealy machines.
2. **Regular Languages** - Pumping lemma of regular sets - Myhill Nerode theorem - Minimization of finite automata - Chomsky hierarchy of languages.
3. **Context-Free Language** - Context-free grammar - Derivation trees - Ambiguity simplification - Normal forms - UVWXY theorem - Applications.
4. **Pushdown Automata** - Definitions - Context free languages - Construction of PDA for simple CFLs - Linear bounded automata.
5. **Turing Machines** - Universal Turing Machines - Types of Turing Machines - Techniques - Halting problem - Stack automata - Definitions.

TEXT:

- J.E.HOPCROFT and J.D.ULLMAN, "Introduction to Automata Theory", Languages and Computation, Pearson Education, 2001
- PETER LINZ, "An Introduction to Formal Language and Automata", Narosa Pub. House, Reprint 2000

CS204

DIGITAL SYSTEM DESIGN

1. **Introduction to VLSI design** - Basic gate design - Digital VLSI design - Design of general boolean circuits using CMOS gates.
2. **Introduction to hardware description languages through Verilog** - Physical modeling - Structural/Data flow modeling - Behavioral modeling.
3. **Advanced Verilog concepts** - Synthesis concepts - Inferring latches and flip-flops - Modeling techniques for efficient circuit design.
4. **Design of high-speed arithmetic circuits** - Parallelism - Pipelined Wallace tree multipliers - Systolic algorithms - Systolic matrix multiplication.

TEXT:

- SAMIR PALNITKAR, "Verilog HDL Synthesis", I Edition, BS Publications, 2001
- BHASKAR, "Verilog HDL Synthesis", I Edition, BS Publications, 2001

CS206

LOGICAL FOUNDATIONS OF COMPUTER SCIENCE

1. **Review of Propositional Calculus** - Validity - Satisfiability related concepts - CNF and DNF forms - Conversion of arbitrary propositional formula to CNF or DNF.
2. **Compactness idea** - Resolution principle and proof of the theorem - Review of predicate calculus - Interpretation of formulae in predicate calculus.
3. **Prenex normal form and examples** - Application of logic in programming - Proof rules for structured statements (assignment, while, repeat-until, for statements).
4. **Pre-conditions / Post-conditions** - Weakest precondition - Notion of machine - Mechanism and W_p as a predicate transformer - Properties of W_p .
5. **Guarded Commands** - General form of **if** command - W_p of **if** - Related theorem - General form of **do** command - W_p of **do** - Need for strong guards.

TEXT:

- D.GRIES, "The Science of Programming", Narosa, 1981
- S.ALAGIC, M.A.ARBIB, "The Design of Well-Structured and Correct Programs", SpringerVerlag, 1978
- E.W.DJIKSTRA, "A Discipline of Programming", Prentice Hall, Englewood Cliffs, 1976

CS208

INTRODUCTION TO ALGORITHMS

1. **Algorithms** - Examples - Tournament method - Evaluating polynomial functions - preprocessing of coefficients - solving recurrence equations.
2. **Divide and Conquer method** - Strassen's matrix multiplication - Greedy method - Knapsack problem - Job sequencing with deadlines - Minimum spanning trees.
3. **Dynamic Programming** - Multistage graphs - All pair's shortest paths - Optimal binary search trees - Traveling salesman problem - Fast Fourier transform.
4. **Randomized Algorithms and Amortized Analysis** - Las Vegas and Monte Carlo types - Randomized quick sort and its analysis - Min-Cut algorithm.
5. **NP-Hard and NP-complete problems** - Basic concepts - Reducibility - Cook's theorem (without proof) - Turing machines - NP-Hard graph problems.

TEXT:

- T.H.CORMEN, C.E. LEISERSON, R.L. RIVEST, "Introduction to Algorithms", The MIT press, Cambridge, Massachusetts and McGraw Hill, 1990
- A.V. AHO, J.E.HOPCROFT and J.D.ULLMAN, "The Design and Analysis of Computer Algorithms", Addison Wesley, 1974

CS210

DIGITAL SYSTEM DESIGN LABORATORY

- Design of a 32-bit carry look-ahead adder with logarithmic depth using Verilog
- Design of a Wallace tree multiplier using Verilog
- Design of a 4-bit DSP processor using Verilog
- Burning the 4-bit DSP processor on a FPGA

CS212

ALGORITHMS LABORATORY

- Estimating worst-case/average-case complexity of algorithms via programs
- Determining machine constants
- Programs involving some advanced data structures
- Implementing example problems
- Illustrating the different paradigms of algorithm design
- Solving miscellaneous problems e.g. problems in string manipulation, graph theory, optimization

MA204

INTRODUCTION TO PROBABILITY THEORY

1. Definitions of Probability - Notion of sample space - Events - Basics of Combinatorial Analysis - Posing Probability problems mathematically - Examples
2. Conditional Probability - Baye's Rule - Random variable - Probability mass function, Density function, Distribution Function - Bernoulli Trials - Binomial Distribution - Poisson Approximation - Poisson Distribution - Normal Distribution - Moment Generating Function
3. Joint Probability Density Function - Marginal and Conditional Densities - Function of Random Variable - Covariance and Conditional Expectation - Correlation Coefficient
4. Chebyshev Inequality - Law of Large Numbers - Central Limit Theorem - Random Process - Markov Dependence, Markov Chains, definition, examples, ergodicity
5. Finite Markov Chain - Various States - Limiting Probability - Introduction to Markov Process - M/M/1 Queues with finite and infinite waiting space.

TEXT:

- W. FELLER, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley Eastern, New Delhi.
- A. PAPOULIS, Probability, Random Variables and Stochastic Processes, McGraw Hill.
- K. S. TRIVEDI, Probability and Statistics with Reliability and Queueing and Computer Science Applications, Prentice Hall of India, 1988
- A. O. ALLEN, Introduction to Probability, Statistics and Queueing Theory with Computer Science Applications, Academic Press, 2006 reprint.

EC214

BASICS OF COMMUNICATION ENGINEERING

1. **AM AND FM SYSTEMS** - Principles of Amplitude Modulation, single and double side band - suppressed carrier system and frequency modulation - varactor diode and reactance modulator - AM detectors - FM discriminators - AM and FM transmitters and receivers.
2. **PULSE AND DIGITAL COMMUNICATION** - Sampling theorem - pulse modulation techniques - PAM, PWM and PPM concepts - PCM encoder and decoder - multiplexing - time division multiplexing and frequency division multiplexing.
3. **DATA COMMUNICATION TECHNIQUES** - Data transmission using analog carriers - MODEMS employing FSK, QPSK, QAM and MSK - asynchronous and synchronous transmission - error

control techniques - data communication protocols - link oriented protocols - asynchronous protocols.

4. **MODERN COMMUNICATION SYSTEMS** - Microwave links, optical communication principles - Satellite communication systems - Pagers - Cellular phones - EPABX.
5. **TELEVISION SYSTEM** - Requirements and Standards - need for scanning - interlaced scanning - VSB modulation - types of camera tubes and picture tubes - B/W and colour systems - PAL - CCTV - Cable TV - Microwave relay systems.

TEXT BOOKS:

- "SIMON HAYKIN ". Communication Systems.
- " RR GULATHI ". Modern Television Engineering and Practice.
- " JOHN G PROAKIS AND M SALEHI ". Communication Systems Engineering.

REFERENCE:

- "KENNEDY". Electronic Communication systems.