Fourth Semester
COMPUTER SCIENCE

Mathematics
M 401
Contact: 3L + IT
Credit: 4

Sets and functions: Groups, Semigroups and monoids, Cyclic semigroups and submonoids, Subgroups and Cosets, Congruence relations on Semigroups. Morphisms, Normal subgroups. Structure of cyclic groups, permutation groups, dihedral groups. Elementary applications in coding theory.

Rings and Boolean algebra: Rings, Subrings, morphism of rings, ideals and quotient rings. Euclidean domains. Integral domains and fields. Boolean Algebra - direct product, Morphisms. Boolean sub-algebra. Boolean Rings. Applications of Boolean algebra in logic circuits and switching functions.

Recursion and Recurrence Relation: Basic idea, Sequence and discrete function. Generating functions and applications.

Graph Thoery: Graphs, Digraphs, Isomorphism, Walks, Paths, Circuits, Shortest Path Problem, Dijkstra's Algorithm, Trees, Properties of Trees, Cotrees and Fundamental Circuits, Shortest Spanning Trees - Kruskal's Algorithm,Prim's Algorithm,DFS,BFS, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Metric Representation of Graphs, Networks, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow.

***Text*:**

1. Liu C. L., "Introduction to combinatorial mathematics", McGraw Hill, 1968.

2 Mott J. L., Kandel A. and Baker T. P., "Discrete mathematics for Computer Scientists and Mathematicians", PH, 1986.

3 Rosen—Discrete Mathematics, 2/e,TMH

4 S.K. Mapa—Higher Algebra (Abstract & Modern)

5 Robert J. McElice , Robert B. Ash & Carol Ash, "Introduction to discrete Mathematics", Tata McGraw Hill

6 Deo N., "Graph Theory with Applications to Engineering and Computer Science", PHI, 1980

7 Tremblay and Manohar, "Discrete mathematical structures with applications to computer science", McGraw Hill, 1975

8 Kolamn, Busby and Ross, "Discrete mathematical structures", 3/ed, PHI, 1996.

9 Fraleigh J. B., "A first course in abstract algebra Narosa", 1990

10 Smullyan R. M., "First Order Logic Springer Verlag", 1968

Reference:

1.Lipschutz—2000 Solved Problems in Discrete Mathematics, TMH

2.Balakrishnan—Graph Theory (Schaum),MH

3.Hararay—Graph Theory

Formal Language and Automata Theory
Code: CS 401
Contact: 3L + IT
Credit: 4

Finite State Machines : Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and liner sequential machines.
Finite State Models : Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines : testing table & testing graph.
Structure of Sequential Machines : Concept of partitions, closed partitions, lattice of closed partitions, decomposition : serial & parallel.
Finite Automation : Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with e-moves, regular sets & regular expressions : equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.
Closure Properties of Regular Sets : Pumping lemma & its application, closure properties minimization of finite automata : minimization by distinguishable pair, Myhill-Nerode theorem.

Context Free Grammars : Introduction, definition, derivation trees, simplification, CNF & GNF.

Pushdown Automata : Definition, moves, Instantaneous Descriptions, language recognised by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

Closure Properties of CFLs : Pumping lemma & its applications, ogden's lemma, closure properties, decision algorithms.

Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

***Text books* :**

1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. K.L.P Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI
3. Ash & Ash – "Discrete Mathematics",TMH
4. Martin—Introduction
5. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
6. Kain, "Theory of Automata & Formal Language", McGraw Hill.

References **:**

1. Kohavi ZVI, "Switching & Finite Automata", 2nd Edn., Tata McGraw Hill.

2. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa
3. "Introduction to Formal Languages", Tata McGraw Hill, 1983.

Operation Research and Optimization Techniques
CS 402
Contact: 3L + IT
Credit: 4

Introduction to OR modelling approach and various real life situations
Linear programming problems and applications, Various components of LP problem formulation, Solving Linear Programming problem using simultaneous equations and Graphical Method, Simplex Method and extensions, Sensitivity analysis - Duality theory, Revised Simplex Transportation and assignment problems

Network Analysis-shortest Paths, Maximal Flow including PERT-CPM. Integer programming concepts, formulation, solution and applications.

Dynamic Programming—Modeling , Optimization, Replacement.

Game Theory—Introduction, Decisions under risk, Decisions under uncertainty

Queuing Theory—Introduction, basic definitions & notations, axiomatic derivation of the arrival & departure distributions for Poission Queue, Poission Queuing model, M/M/I queues in series , application.

Text:

1. Hamdy A. Taha, "Operations Research", Fifth edn. , Macmillan Publishing Company, 1992.
2. V.K. Kapoor-- Operations Research
3. Kanti Swaroop-- Operations Research
4. Hadley G., "Linear Programming", Narosa Publishers, 1987.
5. Hillier & Lieberman—Introduction to Operations Research, 7/e (with CD),TMH
6. Hiller F. and Leibermann G. J., "Operation Research", Holder Day Inc, 1974.

Reference:

1. Operations Research – Schaum outline series, MH

Principles of Communication Engineering
EC 411
Contact: 3L
Credit: 3

Amplitude and Frequency Modulation – their generation and detection Bandwidth requirements Low Power and High Modulators and Modulated amplifiers. Superheterodyne detection. Signal to Noise ratio of A.M. and P.M. transmission.

A/D, D/A Converters. Shannon's sampling Theorem. PAM, PWM, PPM and PCM. Their generation and detection.

Digital Modulation : ASK, FSK, PSK performance evaluation. Time Division Multiplexing and Demultiplexing. Modems, Error control and coding, Channel capacity.

Data Transmission Synchronization, Data protection, error detection and correlation.

Elements of Satellite Communication tracking and control.

Text :

1. Taub H. and Shilling D. L., "Principles of Communication Systems", 2/e,TMH
2. Carlson R. B., "Communication Systems ,4/e, Mc.Graw Hill
3. Haykin S. S., "An Introduction to Analog and Digital Communication Systems", Wiley Eastern.

4. Lathi B. P., "Communication Systems", John Wiley.

Reference:

1.Kennedy—Electronic Communication Systems, 4/e , TMH

Advanced Computer Architecture
CS 403
Contacts: 3L + 1T
Credits: 4

Review of Pipelining, Examples of some pipeline in modern processors, pipeline hazards, data hazards, control hazards. Techniques to handle hazards, performance improvement with pipelines and effect of hazards on the performance.

Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture, vector length and stride issues, compiler effectiveness in vector processors.

SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.

Memory hierarchy, Cache Introduction, Techniques to reduce cache misses, techniques to reduce cache penalties, technique to reduce cache hit times. Effect of main memory bandwidth, effect of bus-width, memory access time, virtual memory, etc.

RISC architectures, addressing modes, instructions formats, effect of simplification on the performance, example processors such as MIPS, PA-RISC, SPARC, Power PC, etc.

MIMID Multiprocessors, Centralized shared architectures, distributed shared memory architectures, synchronization and memory consistency models, message passing architectures, comelier issues. Data flow architectures, Interconnection networks.

Text Books:

1. Hwang, K. "Advanced Computer architecture with parallel programming", McGraw Hill, 1993
2. Carter—Computer Architecture (Schaum Series),TMH

3. Patterson D.A. and Hennessy , J.L. "Computer architecture a quantitative approach", 2nd ed., Morgan Kaufman, 1996
4. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH
5. Stone, H.S., "Advanced Computerat", Addison Wesley, 1989
6. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed., McGraw Hill, 1990

Reference:

Quinn—Parallel Processing

Operation Research Lab

CS-492

Contacts: 3P
Credits: 2

Software based lab using C & FORTRAN .

For FORTRAN:

1) Familiarization with FORTRAN. (3)
2) Linear Programming (Tranportation , Assignment , Duality , Simplex)

For C-Language:

1) Shortest Path(Dijkstra's , Floyd's Algorithm)
2) Maximal Flow.
3) PERT/CPM
4) Queueing Theory
5) Integer Programming Problem (Branch & Bound Problem)

N:B:-Familiarization with any O.R package.

Computer Architecture & Organisation Lab
Code: CS 493
Contacts: 3P
Credits: 2

1. Review of the different logic design ckts., e.g.

   a) Flip/Flop(RS, JK, D, T), b)Register,(4/8 bit Synchronized Data Transfer),
   c)Tri-state logic Gates

2. Familiarity with state of art IC-chips, e.g.

a) Multiplexer , b) Decoder, c) Encoder, d) Counter, e)Shift-Register, f)adder

Truth Table verification and clarification from Data-book.

3. Design a BCD adder.
4. Design an Adder/Subtracter composite unit .
5. Design a carry-look ahead Adder.
6. Design a ripple counter and carry-look ahead counter and assess the complexity of both the ckts.
7. Use a multiplexer unit to design a composite ALU .
8. Design a multiplex display unit using counter, multiplexer, decoder etc.
9. Design a keyboard Encoder unit in 2 Dimension.
10. Test a RAM chip and cascade two chips for vertical and horizontal expansion. Use wired OR tri-state output interconnection.
11. Use ALU chip for multibit arithmetic operation.

Communication Engg. Lab

EC 481

Contacts: 3P

Credits: 2

1. Study of Amplitude modulation & Demodulation technique.
2. Study of Double Side Band Suppressed Carrier (DSB-SC) & Demodulation technique.
3. Study of Single Side Band Suppressed Carrier (SSB-SC) & Demodulation technique.
4. Study of Frequency Modulation & Demodulation.
5. Study of Time Division Multiplexing (TDM) & Demultiplexing.
6. Study of Frequency Shift Keying (FSK).
7. Study of Pulse Amplitude Modulation (PAM).
8. Study of Pulse Width Modulation (PWM).
9. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).

TECHNICAL REPORT WRITING & / LANGUAGE PRACTICE LABORATORY

Code: HU 481

Contact: 3

Credits: 2

Topics to be covered and number of hours required for it: