RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE-Artificial Intelligence/ Artificial Intelligence, IV-Semester

AI 401/ AL401 Introduction to Discrete Structure & Linear Algebra

Unit 1: Set Theory, Relation, Function, Theorem Proving Techniques:Set theory: definition of sets, Venn Diagram, proofs of some general identities on set,Relation: Definition, Types of relation ,Composition of relation ,Equivalence relation, Partial ordering relation,POSET,Hasse diagram and Lattice .

Unit 2:Algebraic structure: Definition, Properties, types: Semi Group, Monoid, Groups, Abelian Group, Properties of group, cyclic group, Normal subgroup, Ring and Fields: definition and standard result, Introduction to Recurrence Relation and Generating Functions.

Unit 3:Propositional logic: Proposition, First order Logic, Basic logical operation, Truth tables, Tautologies and Contradiction, algebra of proposition, logical implication, logical equivalence ,predicates, Normal Forms, Quantifiers Graph theory: Introduction and basic terminology of graph, types of graph, Path, Cycles, Shortest path in weighted graph, graph colorings.

Unit 4: Matrices: Determinant and Trace, Cholesky Decomposition, Eigen decomposition,Singular Value decomposition(SVD),Gradient of a matrix: Useful identities For computing Gradient.

Unit 5: Test of Hypothesis : Concept and Formulation ,Type-I and Type-II Errors, Time Series Analysis

Analysis of Variance (ANOVA).

References:

1. C.L.Liu, “Elements of Discrete Mathematics” Tata Mc Graw-Hill Edition.
2. Trembley, J.P & Manohar; “Discrete Mathematical Structure with Application CS”, McGraw Hill.
3. Kenneth H. Rosen, “Discrete Mathematics and its applications”, McGraw Hill.
4. Bisht, “Discrete Mathematics”,Oxford University Press
5. Biswal,”Discrete Mathematics & Graph Theory”, PHI
6. Mathematics For Machine Learning-Marc Peter Deisenroth,A. Aldo Faisal,Cheng soon ong
7. Statistical Method- S.P. Gupta

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CSE-Artificial Intelligence/ Artificial Intelligence, IV-Semester

AI 402 /AL402 Analysis &Design of Algorithms

Unit I :Definitions of algorithms and complexity, Time and Space Complexity; Time space tradeoff, various bounds on complexity, Asymptotic notation, Recurrences and Recurrences solving techniques, Introduction to divide and conquer technique, example: binary search, merge sort, quick sort, heap sort, strassen's matrix multiplication etc, Code tuning techniques: Loop Optimization, Data Transfer Optimization, Logic Optimization, etc.

Unit II : Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm etc. Correctness proof of Greedy algorithms.

Unit III : Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm etc.

Unit IV : Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph colouring problem etc. Introduction to branch & bound method, examples of branch and bound method like travelling salesman problem etc. Meaning of lower bound theory and its use in solving algebraic problem, introduction to parallel algorithms.

Unit V :Advanced tree and graph algorithms, NP-hard and NP-complete problems, Approximations Algorithms, Data Stream Algorithms, Introduction to design and complexity of Parallel Algorithms.

References:

1. Coremen Thomas, Leiserson CE, Rivest RL, Introduction to Algorithms, Third edition, PHI.
2. Horowitz &Sahani, Analysis & Design of Algorithm, Fourth Edition Computer Science Press.
3. Dasgupta, algorithms, Fifth Edition, TMH
4. Ullmann; Analysis & Design of Algorithm, Addison-wesley publishing company,
5. Michael T Goodrich, RobartoTamassia, Algorithm Design, Wiely India
6. Rajesh K Shukla: Analysis and Design of Algorithms: A Beginner's Approach; Wiley

List of Experiments :

1. Write a program for Iterative and Recursive Binary Search.
2. Write a program for Merge Sort.
3. Write a program for Quick Sort.
4. Write a program for Strassen's Matrix Multiplication.
5. Write a program for optimal merge patterns.
6. Write a program for Huffman coding.
7. Write a program for minimum spanning trees using Kruskal's algorithm.
8. Write a program for minimum spanning trees using Prim's algorithm.
9. Write a program for single sources shortest path algorithm.
10. Write a program for Floye-Warshal algorithm.
11. Write a program for traveling salesman problem.
12. Write a program for Hamiltonian cycle problem.

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AI 403/ AL404: Computer Organization & Architecture

Objectives: Students to be familiarize the basic principles of computer architecture, Designand MultiProcessing, Types of data transfer, Concept of semiconductor memories which is useful for research work in field Computer System.

Unit I :Basic Structure of Computer:Structure of Desktop Computers, CPU: General Register Organization-Memory Register, Instruction Register, Control Word, Stack Organization, Instruction Format, ALU, I/O System, bus,CPU and Memory Program Counter, Bus Structure, Register Transfer Language-Bus and Memory Transfer, addressing modes. Control Unit Organization: Basic Concept of Instruction, Instruction Types, Micro Instruction Formats, Fetch and Execution cycle, Hardwired control unit, Micro- programmed Control unit microprogram sequencer Control Memory, Sequencing and Execution of MicroInstruction.

Unit II :Computer Arithmetic: Addition and Subtraction, Tools Compliment Representation, Signed Addition and Subtraction, Multiplication and division, Booths Algorithm, Division Operation, Floating Point Arithmetic Operation. design of Arithmetic unit

Unit III :I/O Organization: I/O Interface –PCI Bus, SCSI Bus, USB, Data Transfer: Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, Direct Memory Access(DMA), I/OProcessor.

Unit IV : Memory Organization: Main memory-RAM, ROM, Secondary Memory – Magnetic Tape, Disk, Optical Storage, Cache Memory: Cache Structure and Design, Mapping Scheme, Replacement Algorithm, Improving Cache Performance, Virtual Memory, memory management hardware

Unit V: Multiprocessors: Characteristics of Multiprocessor, Structure of Multiprocessor-Inter-processor Arbitration, Inter-Processor Communication and Synchronization. Memory in Multiprocessor System, Concept of Pipelining, Vector Processing, Array Processing, RISC And CISC, Study of Multi core Processor –Intel, AMD.

Reference Books:

1. Morris Mano , “Computer System Organization”PHI
2. Alan Clements: “Computer Organization and Architecture”, Cengage Learning
3. SubrataGhosal: “Computer Architecture and Organization”,Pearson
4. William stalling ,“Computer Architecture and Organization” PHI
5. M. Usha, T.S. Shrikant: “Computer System Architecture and Organization”, Willey India
6. Chaudhuri, P.Pal: “Computer Organization and Design”,PHI
7. Sarangi: “Computer Organization and Architecture”,Mc-GrawHills

List of Experiments :

1. Study of Multiplexer andDemultiplexer
2. Study of Half Adder and Subtractor
3. Study of Full Adder andSubtractor
4. WAP to add two 8 bit numbers and store the result at memory location2000
5. WAP to multiply two 8 bit numbers stored at memory location 2000 and 2001 and stores theresult at memory location 2000 and2001.

6. WAP to add two 16-bit numbers. Store the result at memory address starting from 2000.
7. WAP which tests if any bit is '0' in a data byte specified at an address 2000. If it is so, 00would be stored at address 2001 and if not so then FF should be storedata the same address.
8. Assume that 3 bytes of data are stored at consecutive memory addresses of the data memorystarting at 2000. Write a program which loads register C with (2000), i.e. with data contained at memory address2000, D with (2001), E with (2002) and A with (2001).
9. Sixteen bytes of data are specified at consecutive data-memory locations starting at 2000.Write a program which increments the value of all sixteen bytes by01.
10. WAP to add t 10 bytes stored at memory location starting from 3000. Store the result at memorylocation300A

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CSE-Artificial Intelligence/ Artificial Intelligence, IV-Semester

AI 404/ IT305 Digital Circuits and System

Course Objectives

1 Understand working of logic gates.
2 To design and implement combinational and sequential logic circuits
3 Understand the process of analog to digital and digital to analog conversion4 To understand various logic families

Unit I- Number systems and logic gates: Decimal, Binary, Octal, Hexadecimal number systems and radix conversion. Codes- BCD, excess 3, gray, ASCII. Boolean algebra- Theorems and properties, Boolean functions, canonical and standard forms, De Morgans theorem, digital logic gates, Karnaugh maps.

Unit II- Combinational circuits: Introduction to combinational circuits, multilevel NAND, NOR implementation. Designing binary Adders and Subtractors. Decoder, Encoder, Multiplexer, Demultiplexer circuits.

Unit III- Sequential circuits: Introduction to Sequential circuits, flip-flops, RS, D, T, JK, M/S JK-flipflops, truth tables, excitation tables and characteristic equations, clocked and edge triggered flipflops, Registers- Definition, serial, parallel, shift left/right registers, Johnson counter, asynchronous and synchronous counters.

Unit IV- Digital logic families: Bipolar and unipolar logic families, Digital IC specifications, RTL, DTL, All types of TTL circuits, ECL, IIL, PMOS, NMOS & CMOS Logic.

Unit V- Clocks and timing circuits: Bistable, Monostable & Astable multivibrator, Schmitt trigger circuit, Introduction of Analog to Digital & Digital to Analog converters, Display devices, 7 and 16 segment LED display, LCD.

Course Outcomes

On the completion of this course

1 Students will be able to perform number base conversions, use Boolean logic to create digital circuits.
2. Student can understand use of encoders, decoders, multiplexers and demultiplexers in communication systems.
3 By learning design of combinational and sequential circuits student can understand its use in digital systems such as computers, communication systems and other modern technologies.
4 Study of ADC and DAC along with display devices will enable students to understand signal conversion and its display and their applications in digital devices.

References Books:

1. M. Morris Mono, “Digital logic design”, Pearson Education Pvt. Ltd.
2. A Anand Kumar, “Fundamentals of digital circuits“, PHI Learning Pvt Ltd.
3. A K Maini, “Digital Electronics Principles and Integrated Circuits, Wiley India Pvt Ltd.
4. R P Jain, “Modern Digital Electronics”, Tata McGraw-Hill publishing company Ltd.
5. D P Kothari and J S Dhillon, "Digital Circuits and Design", Pearson Education Pvt. Ltd.

List of Experiments:

1. Study and verify the operation of AND, OR, NOT, NOR and NAND logic gates.
2. Design all basic logic gates using NOR universal gate.
3. Design all basic logic gates using NAND universal gate.
4. Verification of Demorgan's theorem.
5. Construction and verification of half adder andfull adder circuits.
6. Construction and verification of half subtractor and full subtractor circuits.
7. Design of Binary to Grey & Grey to Binary code Converters .
8. Design of BCD to excess-3 code converter.
9. Design and verification of Multiplexer circuit
10. Design and verification of De-multiplexer circuit.

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AI 405 : Knowledge Representation and Reasoning

UNIT-I

Introduction: The Key Concepts: Knowledge, Representation, and Reasoning, Knowledge-Based Systems, The Role of Logic, Propositional Logic basics, Soundness & Completeness, Symbolic Reasoning, Truth, Logic, and Provability.

First-Order Logic: Introduction, The Syntax, The Semantics, Representation in First Order Logic, Interpretations, Denotation, Logical Consequence, Knowledge-Based Systems, Expressing Knowledge Knowledge Engineering, Basic Facts, Complex Fact, Terminological Fact, Entailments, Abstract Individuals, The Rete Algorithm

UNIT-II: Resolution: The Propositional Case, Resolution Derivations, An Entailment Procedure, Handling Variables and Quantifiers, First-Order Resolution, The Unification Algorithm, Answer Extraction, Equality, Dealing with Computational Intractability. Reasoning with Horn Clauses: Horn Clauses, Resolution Derivations with Horn Clauses, Backward Chaining, Forward Chaining.

UNIT-III Representation of relations, Semantic nets, Frames, Description Logics, Description Language, Interpretations, Truth in an Interpretation, Simplifying the Knowledge Base, Normalization, Structure Matching, The Correctness of the Subsumption Computation, Computing Satisfaction, Taxonomies and Classification, A Taxonomy of Atomic Concepts and Constants, Computing Classification, Web Ontology Language

UNIT-IV: Defaults: Introduction, Generics and Universals , Default Reasoning, Non-monotonicity, Closed-World Reasoning, The Closed-World Assumption Consistency and Completeness of Knowledge, Query Evaluation, Consistency and a Generalized Assumption, Quantifiers and Domain Closure, Circumscription, Minimal Entailment, The Circumscription Axiom, Fixed and Variable Predicates, Default Logic, Default Rules Default Extensions Multiple Extensions, Auto epistemic Logic, Stable Sets and Expansions, Enumerating Stable Expansions.

UNIT-V: Actions & Planning: The Situation Calculus, Fluents, Precondition and Effect Axioms, Frame Axioms, Using the Situation Calculus, A Simple Solution to the Frame Problem, Explanation Closure, Successor State Axioms, Complex Actions. Planning and its types.

Reference Books:

1. Knowledge representation and Reasoning, Ronald J. Brachman & Hector J. Levesque, Elsevier (2004); ch 2-6, 9, 11, 14,15.
2. Language, Proof and Logic, Jon Barwise & John Etchemendy, CSLI Publications (1999); ch 9-11.
3. The Description Logic Handbook: Theory, implementation, and applications, Franz Baader, Deborah L. Mc Guinness, Daniele Nardi and Peter F. Patel-Schneider, Cambridge University Press (2010); ch 2, 5-6.