Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III COMPUTER ORGANIZATION AI201		L	T	P	Credit
	Scheme	3	1	0	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	acquire knowledge of basics of computer architecture, its components with peripheral devices, instruction set architecture, instruction execution using data path and control unit interface.
CO2	apply knowledge of combinational and sequential logic circuits to mimic simple computer architecture to solve the given problem.
CO3	analyze performance of various instruction set architecture, control unit, memories, various processor architectures.
CO4	evaluate programming solutions to implement fast methods of ALU, FP unit implementations, processor architectures and instruction set architectures.
CO5	implement fast methods of ALU, FP unit implementations and to design and develop hardware solution for given instruction coding scheme of an Instruction Set Architecture or vice versa using available technology tools.

2.	Syllabus	
	PROCESSOR BASICS	**(05 Hours)**
	Basics CPU Organization - Functional Units, Data Paths, Registers, Stored Program Concept, Data Representation - Basic Formats, Fixed and Floating Point Representation, Instruction Sets, Instruction Types, Instruction Formats, Addressing Modes, Designing of an Instruction Set, Data path Design, Concepts of Machine Level Programmig, Assembly Level Programming and High Level Programming.	
	ARITHMETIC AND LOGIC UNIT	**(08 Hours)**
	Arithmetic and Logical Operation and Hardware Implementation, Implementation of some Complex Operation: Fixed-Point Arithmetic Multiplication Algorithms-Hardware Algorithm, Booth Multiplication Algorithm, Division Algorithm, Divide Overflow Algorithm, Combinational ALU and Sequential ALU, Floating Point Arithmetic Operations.	
	CONTROL UNIT	**(07 Hours)**
	Basic Concepts, Instruction Interpretation and Execution, Hardwired Control, Microprogrammed Control, CPU Control Unit Design, Performance.	

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	SUBROUTINE MANAGEMENT	**(03 Hours)**
	Concepts of Subroutine, Subroutine Call and Return.	
	MEMORY ORGANIZATION	**(06 Hours)**
	Concepts of Semiconductor Memory, Cpu-Memory Interaction, Organization of Memory Modules, Cache Memory and Related Mapping and Replacement Policies, Virtual Memory.	
	SYSTEM ORGANIZATION	**(05 Hours)**
	Introduction to InputAnd Output Processing, Working with Video Display Unit and Keyboard and Routine to Control them, Programmed Controlled I/O Transfer, Interrupt Controlled I/O Transfer, DMA Controller, Secondary Storage and Type Of Storage Devices, Introduction to Buses and Connecting I/O Devices to CPU and Memory.	
	PIPELINE CONTROL AND PARALLEL PROCESSING	**(08 Hours)**
	Instruction Pipelines, Pipeline Hazards, Pipeline Performance, Superscalar Processing, Introduction to Parallel Processing, Processor-Level Parallelism, Multiprocessor.	
	Tutorials will be based on the coverage of the above topics separately.	**(14 Hours)**
	(Total Contact Time: 42 Hours + 14 Hours = 56 Hours)	

3. Tutorials:
1. Problems on data conversion in various formats and floating-point representation
2. Solving computations involving complex arithmetic operations and hardware implementation of the same
3. Interpretation of basic instruction execution and various addressing modes possible
4. Learning instruction set architecture level instructions for the high level language programming
5. Problems on memory management, mapping and replacement policies

4. Books Recommended:

1. John L. Hannessy, David A. Patterson, "Computer organization and Design", 3/E, Morgan Kaufmaan, reprint - 2003.
2. Andrew S. Tanenbaum, "Structured Computer Organization", 6/E, PHI EEE, reprint 1995.
3. William Stallings, "Computer Organization & Architecture: Designing For Performance", 6/E, PHI, 2002.
4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5/E, McGraw-Hill, 2002.
5. Morris Mano, "Computer Systems Architecture", 3/E, PHI, reprint 1997.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DATABASE MANAGEMENT SYSTEMS AI203		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	understand different database models and query languages to manage the data for given real life application scenario.
CO2	apply the concept of database model, relational tables, normalization to solve different problems.
CO3	analyze the problems for designing the effective solution using procedural and nonprocedural languages and/or index.
CO4	evaluate the solution using transaction management, concurrency management, query performance and optimization, or recovery.
CO5	implement an efficient solution using industry standards for real life problems.

2.	Syllabus	
	INTRODUCTORY CONCEPTS OF DBMS	**(02 Hours)**
	Introduction, Applications of DBMS, Purpose of Database, Data Independence, Database System Architecture, Data Abstraction, Database users and DBA.	
	ENTITY RELATIONSHIP MODEL	**(06 Hours)**
	Basic Concepts, Design Process, Constraints, Keys, Design Issues, E-R Diagrams, Attribute Types, Mapping Cardinality, Types of Relationship, Weak/Strong Entity Sets, Extended E-R Features – Generalization, Specialization, Aggregation.	
	RELATIONAL MODELS	**(04 Hours)**
	Structure of Relational Databases, Domains, Relations, Mapping of ER Model to Relational Model, Relational Algebra – Fundamentals, Operators and Syntax, Relational Algebra Queries, Tuple Relational Calculus.	
	RELATIONAL DATABASE DESIGN	**(08 Hours)**
	Functional Dependency – Definition, Trivial and Non-trivial FD, Closure of FD Set, Closure of Attributes, Irreducible Set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- Dependency	

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	Preservation, BCNF, Multi- Valued Dependency, 4NF, Join Dependency and 5NF.	
	QUERY PROCESSING AND OPTIMIZATION	**(04 Hours)**
	Overview of Query Processing, Measures of Query Cost, Select Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Overview of Query Optimization, Transformation of Relational, Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views, Advanced Topics in Query Optimization.	
	TRANSACTION MANAGEMENT	**(06 Hours)**
	Transaction Concepts, Properties of Transactions, Serializability of Transactions, Testing for Serializability, Concurrent Executions of Transactions and Related Problems, Locking Mechanism, Solution to Concurrency Related Problems, Two-phase Locking Protocol, Deadlock, Isolation, Intent Locking, System Recovery, Recovery and Atomicity, Log-based Recovery.	
	SQL CONCEPT	**(04 Hours)**
	Basics of SQL, DDL,DML,DCL, Structure – Creation/Alteration, Defining Constraints – Primary Key, Foreign Key, Unique, Not Null, Check, IN Operator.	
	PL-SQL CONCEPT	**(04 Hours)**
	Cursors, Stored Procedures, Stored Function, Database Triggers.	
	ADVANCED TOPICS	**(04 Hours)**
	Data Security: Introduction, Discretionary Access Control, Mandatory Access Control, Data Encryption, Semi Structured Data and XML, Object Oriented and Object Relational DBMS, Distributed DBMS, NOSQL DBMS.	
	Tutorials will be based on the coverage of the above topics separately	**(14 Hours)**
	Practicals will be based on the coverage of the above topics separately	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3.	**Tutorials:**
1	Introduction and application of DBMS
2	Designing Relational Models, ER Models and Relational databases
3	Query solving using SQL and PL/SQL
4	Optimum query designing

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5	Managing Locks for the management of Transactions and concurrent access of the database

4.	**Practicals:**
1	Implementation for Physical data storage (Sequential, Index Sequential..)
2	Practicing DDL and DML Queries for database creation and managing the data
3	Develop a Database system for the real life application scenario by managing the storage constrains
4	Practicing PL/SQL with the designed databases
5	Design considering Transaction management and concurrency control
6	Design of ER model based example
7	Design of Relational model based example
8	Design of Normalized form of database

5. Books Recommended:

1. A Silberschatz, H. F. Korth, and S Sudarshan, "Database System Concepts", 6/E, TMH, 2010.
2. McFadden, F.Hoffer, Prescott : M. B "Modern database management", 8/E, Benjamin/Cummings Inc,2006.
3. C.J Date, "An Introduction to Database Systems", Publisher: Addison, Wesley, 8/E, 2003.
4. Raghu Ramakrishnan and Gehrke: "Database Management System", 3/E, WCB/McGraw-Hill, 2003.
5. Margaret H. Dunham, "Data Mining: Introductory and advanced topics", Pearson Education, 2003.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DESIGN AND ANALYSIS OF ALGORITHMS AI205		L	T	P	Credit
	Scheme	3	1	0	04

1. Course Outcomes (COs): At the end of course, students will be able to	
CO1	Acquire knowledge about the application of mathematical formula and technique to solve the problem and computational complexity analysis.
CO2	Apply the different algorithm design techniques for designing a solution of different applications.
CO3	Analyse the performance of algorithms using different algorithmic design techniques based on asymptotic or amortized or probabilistic methods.
CO4	Evaluate the correctness and implementation of algorithms using different methods of performance evaluation.
CO5	Design and innovate efficient algorithms in the field of computer science & engineering and industry related applications using the different algorithm design techniques.

2.	Syllabus	
	INTRODUCTION	**(04 Hours)**
	Introduction to Algorithms, Analysis and Design Techniques, Analysis Techniques: Mathematical, Empirical and Asymptotic Analysis. Recurrence Relations and Solving Recurrences, Mathematical Proof Techniques, Amortized Analysis, Probabilistic Analysis.	
	DIVIDE AND CONQUER APPROACH	**(06 Hours)**
	Sorting & Order Statistics, Divide and Conquer Technique, Various Comparison based Sorts, Analysis of the Worst-Case and the Best-Cases, Randomized Sorting Algorithms, Lower Bound on Sorting, Non-comparison based Sorts, Medians and Order Statistics, Min-Max Problem, Polynomial Multiplication, Fast Fourier Transform.	
	GREEDY DESIGN TECHNIQUES	**(08 Hours)**
	Basic Greedy Control Abstraction, Motivation, Thirsty Baby Problem, Formalization, Activity Selection and its Variants, Huffman Coding, Horn Formulas, Tape Storage Problem, Container Loading Problem, Knapsack Problem, Graph Algorithms, Graph algorithms: All-pairs Shortest Paths, Topological Ordering of DAG, DFS in Directed Graphs, Strongly Connected Components, Minimum Spanning Trees, Single Source Shortest Paths, Maximum Bipartite Cover Problem, Network Flows: Ford Fulkerson Algorithm, Max-flow Min-cut Theorem, Polynomial Time Algorithms for Max-flow.	
	DYNAMIC PROGRAMMING	**(08 Hours)**

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	Motivation, Matrix Multiplication Problem, Assembly Line Problem, Coin Changing Problem, Longest Common Subsequence, 0/1 Knapsack problem, All-pairs Shortest Path Problems, Dynamic Programming Control Abstraction, Optimal Binary Search Tree.	
	SEARCHING ALGORITHMS	**(04 Hours)**
	Backtracking, N-Queens Problem, Sum of Subset Problem, Complexity Analysis, Branch & Bound, Least Cost Branch & Bound (LCBB), LCBB Complexity Analysis, 15-Puzzle Problem, Traveling Sales Person Problem.	
	NUMBER THEORETIC ALGORITHMS	**(06 Hours)**
	Number Theoretic Notions, GCD, Modular Arithmetic, Chinese Remainder Theorem, Generators, Cyclic Groups, Galois Fields, Applications in Cryptography, Primality Testing.	
	NP-COMPLETE PROBLEMS	**(06 Hours)**
	Polynomial Time, Verification, NP-completeness, Search Problems, Reductions, Dealing with NP-Completeness, Approximation Algorithms, Local Search Heuristics.	
	Tutorials will be based on the coverage of the above topics.	**(14 Hours)**
	Practicals will be based on the coverage of the above topics.	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3. Practicals:

1. Practical based on time analysis of sorting algorithms.
2. Practical based on divide and conquer technique.
3. Practical based on greedy design technique.
4. Practical based on dynamic programming.
5. Practical based on searching algorithms.
6. Practical based on back tracking technique.
7. Practical based on Graph based algorithms.
8. Practical based on branch and bound technique.

4. Books Recommended:

1. Cormen, Leiserson, Rivest, Stein," Introduction to Algorithms", 3/E, MIT Press, 2009.
2. J. Kleinberg, E. Tardos, "Algorithm Design", 1/E, Pearson Education, Reprint 2006.
3. SartajSahni, "Data Structures, Algorithms and Applications in C++", 2/E, Universities Press/Orient Longman, 2005

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4. Sara Baase, Allen van Gelder," Computer Algorithms: Introduction to Design & Analysis, 3/E, Pearson Education, 2000.
5. Knuth, Donald E., "The Art of Computer Programming, Vol I &III", 3/E, Pearson Education, 1997.

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B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III DISCRETE MATHEMATICS AI207		L	T	P	Credit
	Scheme	3	1	0	04

1. Course Outcomes (COs):

At the end of the course, students will be able to

CO1	acquire knowledge of sets, group and functions, graphs.
CO2	apply group theory, relations and lattice.
CO3	analyse functions, counting and based on mathematical logic.
CO4	evaluate formal verification of computer programmes.
CO5	design solutions for various types of problems in different disciplines like information security, optimization, mathematical analysis.

2.	Syllabus	
	Introduction	**(04 Hours)**
	Introduction to set theory, Basics of functions, Application of Functions in Computer Science Areas.	
	GROUP THEORY	**(08 Hours)**
	Basic Properties of Group, Groupoid, Semigroup & Monoid, Abelian Group, Subgroup, Cosets, Normal Subgroup, Lagrange's Theorem, Cyclic Group, Permutation Group, Homomorphism & Isomorphism of Groups, Basic Properties, Error Correction & Detection Code.	
	RELATION & LATTICES	**(05 Hours)**
	Definition & Basic Properties, Graphs Of Relation, Matrices Of Relation, Equivalence Relation, Equivalence Classes, Partition, Partial Ordered Relation, Posets, Hasse Diagram, Upper Bounds, Lower Bound, GLB & LUB Of Sets, Definition & Properties Of Lattice, Sub Lattice, Distributive & Modular Lattices, Complemented & Bounded Lattices, Complete Lattices & Boolean Algebra.	
	MATHEMATICAL LOGIC AND PROGRAM VERIFICATION	**(05 Hours)**
	Induction, Propositions, Combination Of Propositions, Logical Operators & Propositional Algebra, Equivalence, Predicates & Quantifiers, Interaction of Quantifiers with Logical Operators, Logical Interference & Proof Techniques, Formal Verification of Computer Programs (Elements of Hoare Logic).	
	COUNTING AND RECURRENCE RELATION	**(05 Hours)**
	First Counting Principle, Second Counting Principle, Permutation, Circular Permutations, Combination, Pigeonhole Principle, Recurrence Relations, Linear Recurrence Relations, Inclusion And Exclusion,	

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	Generating Functions.	
	BASICS OF GRAPHS	**(05 Hours)**
	Graph Definition, Graph Representation, Basic Concepts Of Finite & Infinite Graph, Incidence & Degree, Isomorphism, Subgraph, Walk, Path & Circuits, Cliques, Cycles and Loops, Operations On Graphs, Connected Graph, Disconnected Graph & Components, Complete Graph, Regular Graph, Bipartite Graph, Planar Graphs, Weighted Graphs, Directed & Undirected Graphs, Connectivity Of Graphs.	
	GRAPHS ALGORITHMS	**(10 Hours)**
	Flows, Combinatorics, Euler's Graph, Hamiltonian Paths & Circuits, Activity Planning and Critical Path, Planar Graphs: Properties, Graph Coloring, Vertex Coloring, Chromatic Polynomials, Edge Coloring, Planar Graph Coloring, Matching and Factorizations: Maximum Matching In Bipartite Graphs, Maximum Matching In General Graphs, Hall's Marriage Theorem, Factorization; Networks: Max-Flow Min-Cut Theorem, Menger's Theorem, Graph and Matrices; Probabilistic Graphical Models:Graphical models, Directed models: Bayesian network, Undirected model: Markov Random Fields, Dynamic model: Hidden Markov Model, Learning in Graphical models: Parameter estimation, Expectation Maximization.	
	Tutorials will be based on the coverage of the above topics separately	**(14 Hours)**
	(Total Contact Time: 42 Hours + 14 Hours = 56 Hours)	

3. Books Recommended:

1. Rosen K.H., "Discrete Mathematics and Its Applications", 6/E, MGH, 2006.
2. Liu C.L., "Elements of Discrete Mathematics", MGH, 2000.
3. Deo Narsingh., "Graph theory with applications to Engineering & Computer Science", PHI, 2000.
4. J. A.Bondy and U. S. R.Murty, "Graph Theory", Springer, 2008.
5. V. K. Balakrishnan, "Theory and Problems of Graph Theory", Tata McGraw-Hill, 2007.

ADDITIONAL REFERENCE BOOKS

1. Kolman B., Busby R.C. & Ross S., "Discrete Mathematical Structure", 5/E, PHI, 2003.
2. Tremblay J. P. & Manohar R., "Discrete Mathematical structure with applications to computer science", MGH, 1999.
3. D. B. West, "Introduction to Graph Theory", 2nd Edition, PHI 2002.
4. G. Chatrand and O.R. Ollermann, "Applied and Algorithmic Graph Theory", McGraw Hill, 1993.

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Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – III OBJECT ORIENTED PROGRAMMING AI231		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes(COs): At the end of the course, students will be able to	
CO1	acquire knowledge of object oriented programming.
CO2	apply the knowledge of object oriented concepts to solve the real world problems.
CO3	analyse object oriented concepts to solve the problem efficiently.
CO4	evaluate the object oriented features' suitability for the implementation of the problem.
CO5	design and implement the efficient object oriented program using various object oriented concepts.

	Syllabus:	
	Introduction	**(06 Hours)**
	Review of High Level Language, Difference between Procedure Oriented and Object Oriented Approach; Characteristics of Object-Oriented Languages Object Oriented Concepts: Objects, Classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism; Dynamic Binding, Message Passing; , Types of Operators, Operator precedence and associativity, Data type conversions; Selection and Loops	
	Classes and Objects	**(08 Hours)**
	Abstract data types, Object and classes, attributes, methods, Class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.	
	Inheritance	**(06 Hours)**
	Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs. classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.	
	Polymorphism	**(06 Hours)**
	Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions, Late Binding, Abstract Classes.	

	Strings, Files and Exception Handling	**(04 Hours)**
	Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration, unexpected exceptions, exception when handling exceptions, resource capture and release.	
	Dynamic memory management	**(04 Hours)**
	Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.	
	Standard Template Library	**(08 Hours)**
	Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors, Usage of Template Library for the Implementation of Data Structure.	
	Practicals will be based on the coverage of the above topics separately.	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3. Practicals using C++/JAVA:

1. Creation of objects in programs.
2. Experiments with private, public member variables and functions and friend functions.
3. Experiments for the usage of constructors and destructors.
4. Experiments for the working of operator overloading.
5. Experiments with abstract classes, interfaces and inheritance to access objects.
6. Experiments with polymorphism and virtual functions.
7. Experiments for strings manipulation.
8. Experiments on file handling.
9. Implementing common data structures, such as trees, lists and hash tables.
10. To deal with runtime errors using exception handling mechanism.
11. Implementation of mini project using object oriented concepts.

4. Books Recommended:

1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Education (India).
2. E. Balagurusamy, "Programming with JAVA", McGraw Hill.
3. Yashwant Kanetkar, "Object Oriented Programming using C++", BPB, 2004.
4. R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.

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5. Naughton P. and Schildt H., "Java2 Complete Reference", Eighth Edition, Tata McGraw Hill, 2011.

ADDITIONAL REFERENCE BOOKS

1. Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
2. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
3. Jaime Nino, Fredrick A. Hosch, "An Introduction to Programming and Object Oriented Design using Java", Wiley India Private Limited, 2010.

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B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV ARTIFICIAL INTELLIGENCE AI202		L	T	P	Credit
	Scheme	3	0	2	04

1. **Course Outcomes (COs):** **At end of the program, students will be able to**	
CO1	understand the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO2	apply various knowledge representation technique, searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO3	analyse the current scope, potential, limitations, and implications of intelligent systems.
CO4	evaluate the AI techniques suitable for recent areas of applications like expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.
CO5	design a real world problem for implementation and understand the dynamic behaviour of a system.

2.	**Syllabus**	
	INTRODUCTION TO AI	**(03 Hours)**
	Intelligent Agents, AI Techniques, AI-Problem formulation, AI Applications, Production Systems, Control Strategies.	
	KNOWLEDGE REPRESENTATION	**(06 Hours)**
	Knowledge Representation Using Predicate Logic, Introduction to Predicate Calculus, Resolution, Use of Predicate Calculus, Knowledge Representation Using other Logic-Structured Representation of Knowledge.	
	PRODUCTION SYSTEM	**(06 Hours)**
	Defining the Problems as a State Space Search, Production Systems, Production Characteristics, Production System Characteristics, Forward and Backward, State-Space Search, Problem Solving Methods – Problem Graphs, Matching, Indexing.	
	PROBLEM-SOLVING THROUGH SEARCH	**(06 Hours)**
	Generate and Test, BFS, DFS, Blind, Heuristic, Problem-Reduction, A, A*, AO*, Minimax, Constraint Propagation, Neural, Stochastic, and Evolutionary Search Algorithms, Sample Applications, Measure of Performance and Analysis of Search Algorithms, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis, Issues in the Design of Search Programs.	

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	KNOWLEDGE INFERENCE	**(06 Hours)**
	Knowledge Representation -Production Based System, Frame Based System; Inference – Backward Chaining, Forward Chaining, Rule Value Approach; Fuzzy Reasoning – Certainty Factors, Bayesian Theory-Bayesian Network-Dempster – Shafer Theory; Symbolic Logic Under Uncertainty: Non-Monotonic Reasoning, Logics for Non-Monotonic Reasoning; Statistical Reasoning : Probability and Bayes Theorem, Certainty Factors, Probabilistic Graphical Models, Bayesian Networks, Markov Networks, Fuzzy Logic.	
	GAME PLAYING AND PLANNING	**(06 HOURS)**
	Overview and Example Domain: Overview, Minimax, Alpha-Beta Cut-Off, Refinements, Iterative Deepening, The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques.	
	NATURAL LANGUAGE PROCESSING	**(04 Hours)**
	Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking.	
	EXPERT SYSTEMS	**(05 Hours)**
	Expert Systems, Architecture of Expert Systems, Roles of Expert Systems, Knowledge Acquisition, Meta Knowledge, Heuristics, Typical Expert Systems – MYCIN, DART, XOON, Expert Systems Shells.	
	Practicals will be based on the coverage of the above topics using prolog.	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours = 70 Hours)	

3.	**Practicals:**
1	Practical assignment to understanding basic concepts of prolog.
2	Practical assignment to implement various search strategies.
3	Practical assignment to implement various algorithm based on game theory.
4	Implementation of heuristic based search techniques.
5	Implementation of neural network based application.
6	Implementation of fuzzy logic based application.
7	Implementation of fuzzy inference engine for an application.
8	Implementation of neuro-fuzzy based system.

4. Books Recommended:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998,
4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2010.
5. I. Bratko, "Prolog Programming for Artificial Intelligence", 3/E, Addison-Wesley, 2001, 0-201-40375-7.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV OPERATING SYSTEMS AI204		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of course, students will be able to	
CO1	understand the significance of operating system in computing devices, exemplify the communication between application programs and hardware devices through system calls.
CO2	compare and illustrate various process scheduling algorithms.
CO3	apply appropriate memory and file management schemes.
CO4	illustrate various disk scheduling algorithms.
CO5	design access control and protection based modules for an operating system.

2.	Syllabus	
	OPERATING SYSTEM OVERVIEW	**(03 Hours)**
	Operating System (OS) Objectives, Evolution, Types, Major Achievements, Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore.	
	PROCESSES AND THREADS	**(05 Hours)**
	Process Concept, Process States, Process Description, Process Control Block, PCB as a Data Structure in Contemporary Operating Systems, Process Hierarchy, Processes vs Threads, Types of Threads, Multicore and Multithreading, Case Study: Linux & Windows Process and Thread Management and its Related System Calls.	
	CONCURRENCY: MUTUAL EXCLUSION AND SYNCHRONIZATION	**(04 Hours)**
	Principles of Concurrency, Mutual Exclusion, Semaphores, Monitors, Message Passing, Readers/Writers Problem.	
	CONCURRENCY: DEADLOCK AND STARVATION	**(04 Hours)**
	Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher's Problem, Case Study: Linux & Windows Concurrency Mechanism.	
	SCHEDULING	**(08 Hours)**

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	Uniprocessor Scheduling: Long Term Scheduling, Medium Term Scheduling, Short Term Scheduling, Scheduling Algorithms: Short Term Scheduling Criteria, Use of Priorities, Alternative Scheduling Policies, Performance Comparison, Fair-Share Scheduling. Multiprocessor Scheduling: Granularity, Design Issue, Process Scheduling, Thread Scheduling, Real-Time Scheduling: Characteristics of RTOS, Real-Time Scheduling, Deadline Scheduling, Rate Monotonic Scheduling, Priority Inversion. Case Study: Linux & Windows Scheduling.	
	MEMORY MANAGEMENT	**(05 Hours)**
	Memory Hierarchy, Static and Dynamic Memory Allocation, Overview of Swapping, Multiple Partitions, Contiguous and Non-Contiguous Memory Allocation, Concepts of Simple Paging, Simple Segmentation.	
	VIRTUAL MEMORY	**(05 Hours)**
	Virtual Memory Concepts, Paging and Segmentation using Virtual Memory, Protection and Sharing, Fetch Policy, Placement Policy, Replacement Policy, Resident Set Management, Cleaning Policy, Load Control, Case Study: Linux & Windows Memory Management.	
	I/O MANAGEMENT AND DISK SCHEDULING	**(04 Hours)**
	I/O Device, Organisation of the I/O Function, Operating System Design Issue, I/O Buffering, Disk Scheduling, RAID, Disk Cache, Case Study: Linux & Windows I/O.	
	FILE MANAGEMENT	**(04 Hours)**
	Overview of : Files & File Systems, File Structure, File Management Systems, File Organisation and Access, B-tree, File Directories, File Sharing, Record Blocking, Secondary Storage Management, File System Security, Case Study: Linux & Windows File System.	
	Practicals will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)	

3.	**Practicals:**
1	Introduction to Basic and Advance commands of Linux.
2	Introduction to Shell Script and programs based on it.
3	Practical based on different Memory management scheme.
4	Practical based on different Process scheduling algorithm.
5	Practical based on different Disk scheduling algorithm.
6	Process synchronization and deadlock.
7	Practical based on file management system.
8	Practical based on input output device management.

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5. Books Recommended:

1. Silberschatz, Galvin and Gagne, "Operating System Concepts", 10/E, John Wiley & Sons, 2018.
2. W. Stallings, "Operating Systems: Internals and Design Principles", 9/E, Pearson Pub., 2017.
3. W Richard Stevens, Stephen A Rago, "Advanced Programming in the UNIX Environment"; 3/E, Addison Wesley Professional, 2013.
4. Kernighan & Pike, "UNIX programming Environment", 2/E, PHI-EEE, 2001.
5. A Tanenbaum, A Woodhull, "Operating Systems - Design and Implementation", 3/E, PHI EEE, 2006.

ADDITIONAL REFERENCE BOOKS

1. Crawley, "Operating Systems - A Design Oriented Approach", 1/E, McGraw Hill, 1998.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV AUTOMATA AND FORMAL LANGUAGES AI206	L	T	P	Credit
Scheme	3	1	0	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	acquire knowledge of the basis of theory of computation, different computational problems and the importance of automata as a modelling tool of computational problems.
CO2	to apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO3	analyse the solutions for different problems and argue formally about correctness on different restricted machine models of computation.
CO4	evaluate and Identify limitations of computational models and possible methods of proving them.
CO5	design the solution in the forms of different types of machine with correctness proof and able to develop different system software.

2.	Syllabus	
	INTRODUCTION	(05 Hours)
	Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages; Mathematical Induction: Inductive Proofs, Principles, Recursive Definitions, Set Notation.	
	FINITE AUTOMATA AND REGULAR EXPRESSIONS	(12 Hours)
	Finite State Systems, Deterministic Finite Automata; Nondeterministic Finite Automata, Nondeterministic Finite Automata with Epsilon, Applications, Kleene' Theorem; Two-way Finite Automata, Finite Automata with Output, Regular Languages & Regular Expressions, Properties of Regular Sets: The Pumping Lemma for Regular Sets, Closure Properties, Decision Properties of Regular Languages, Equivalence and Minimization of Automata, Moore and Mealy Machines.	
	CONTEXT FREE GRAMMARS	(14 Hours)
	Definition, Derivation Trees & Ambiguity, Inherent Ambiguity, Parse Tree, Application of CFG, Simplification of CFG, Normal Form of CFG, Chomsky Normal Form and Chomsky Hierarchy, Unrestricted Grammars, Context-Sensitive Languages, Relations between Classes of Languages, Properties of Context Free Languages: The Pumping Lemma, Closure Properties, Decision Properties of CFL.	
	PUSHDOWN AUTOMATA	(05 Hours)
	Definitions, Languages of PDA, Equivalence of PDA and CFG , Deterministic PDA.	
	TURING MACHINES	(06 Hours)

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	Turing Machine Model, Language of a Turing Machine (TM), Programming Techniques of the TM, Variations of TM, Multiple TM, One-Tape and Multi-Tape TM, Deterministic and Non deterministic TM, Universal TM, Churche Thesis, Recursively Enumerable Languages, Decidability, Reducibility, Intractable Problem Classes of Problems NP Hard, NP Complete.	
	Tutorials will be based on the coverage of the above topics.	**(14 Hours)**
		(Total Contact Time: 45 Hours + 15 Hours = 56 Hours)

3.	**Tutorials:**
1	Problem statements based on Regular Language and Finite Automata.
2	Questions based on Context Free Grammar.
3	Problems regarding Push Down Automata.
4	Solving Problems for Turing Machine.
5	Decidable and Undecidable Problems.

4. Books Recommended:

1. Michael Sipser, "Introduction to the Theory of Computation",Cengage Learning, 3/E, 2013.
2. John C Martin, "Introduction to Languages & the Theory of Computation", 3/E, Tata McGraw-Hill, 2011.
3. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata theory, languages computation, 3/E, Pearson India, 2008.
4. Daniel I A Cohen, "Introduction to Computer Theory", John Wiley & Sons, 2/E, Reprint 2008.
5. Andrew Ilachinski, "Cellular Automata", 1st Ed., World Scientific, 2001.

ADDITIONAL REFERENCE BOOKS

1. Sushil Kumar Azad, "Theory of Computation, An introduction to /automata, Formal Languages And Computability", Dhanpat Ray & Co., New Delhi, 2005.
2. A.M. Natarajan, A.Tamilarasi, "Theory of computation", New Age Publication, 1/E, 2003.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV COMPUTER NETWORKS AI208		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	understand computer network models and services offered at different layers of network protocol stack.
CO2	apply knowledge of data communication, data transmission techniques using various transmission media to deliver error free data and communicate with multiple nodes.
CO3	analyse various routing methods to identify effective routing protocols.
CO4	evaluate network performance by means of transport and flow control protocols, Congestion Control protocols and Quality of services.
CO5	create a computer network application using modern network tools and simulation softwares.

2.	Syllabus	
	INTRODUCTION	**(06 Hours)**
	Overview of Computer Networks and Data Communication, Computer Networking Protocols and Standards, Types of Computer Networks, Network Topology, Protocol Hierarchies and Design Issues, Interfaces and Services, Networking Devices, OSI and TCP/IP Reference Models.	
	PHYSICAL LAYER	**(06 Hours)**
	Physical Layer Design Issues, Data Transmission Techniques, Multiplexing, Transmission Media, Asynchronous Communication, Wireless Transmission, ISDN, ATM, Cellular Radio, Switching Techniques and Issues.	
	LOGICAL LINK CONTROL LAYER	**(06 Hours)**
	LLC Design Issues, Framing, Error and Flow Control, Framing Techniques, Error Control Methods, Flow Control Methods, PPP and HDLC.	
	MEDIUM ACCESS CONTROL LAYER	**(06 Hours)**
	MAC Layer Design Issues, Channel Allocation Methods, Multiple Access Protocols - ALOHA, CSMA, CSMA/CD Protocols, Collision Free Protocols, Limited Contention Protocols, LAN Architectures, IEEE -802 Standards, Ethernet(CSMA/CD), Token Bus, Token Ring, DQDB, FDDI, Bridges and Recent Developments.	
	NETWORK LAYER	**(06 Hours)**

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	Network Layer Design Issues, Routing Algorithms and Protocols, Congestion Control Algorithms and QoS, Internetworking, Addressing, N/W Layer Protocols and Recent Developments.	
	TRANSPORT LAYER	**(06 Hours)**
	Transport Layer Design Issues, Transport Services, Sockets, Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Transport Layer Protocols, Real Time Transport Protocol (RTP), Stream Control Transmission Protocol (SCTP), Congestion Control, QoS and Recent Developments, Virtualization, Network Functions Virtualization(NFV), Software Defined Networks.	
	APPLICATION LAYER	**(06 Hours)**
	Client Server Model, Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP) and Recent Developments.	
	Practicals will be based on the coverage of the above topics separately	**(28 Hours)**
	(Total Contact Time: 42 Hours + 28 Hours= 84 Hours)	

3. Practicals:	
1	Study network configuration commands and computer network setup.
2	Implementation of different Data Link and MAC Layer protocols.
3	Implementationof different Network Layer protocols.
4	Implementation of different Transport and Application Layer protocols.
5	Design and configure a network systems using modern network simulator softwares.
6	Implementation of Secured Socket Layer protocol.
7	Implementation of ICMP based message transmission over network.
8	Implementation of SMTP protocol for mail transfer.

4. Books Recommended:

1. William Stalling, "Data and Computer Communication", 10/E, Pearson India, 2017.
2. B. Forouzan, "Data Communication and Networking", 5/E, McGraw Hill, 2017.
3. Douglas E. Comer, "Internetworking with TCP/IP Volume – I", 6/E Pearson India, 2015.
4. Andrew S. Tanenbaum, "Computer Network", 5/E, Pearson India, 2013.
5. W. Richard Stevens, "TCP/IP Illustrated Volume - I", 2/E, Addison Wesley, 2011.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Artificial Intelligence
B.Tech. Artificial Intelligence

B. Tech. II (AI) Semester – IV MICROPROCESSOR AND INTERFACING TECHNIQUES AI232		L	T	P	Credit
	Scheme	3	0	2	04

1. Course Outcomes (COs): At the end of the course, students will be able to	
CO1	Acquire knowledge of diff erent architectures, addressing modes and instructi ons of 8085/86.
CO2	Interface memory, I/O devices and interrupt controller with 8085/86 microprocessors
CO3	Analyse and compare the features of microprocessors and microcontrollers.
CO4	Describe the internal architecture and diff erent modes of operati ons of a typical peripheral device.
CO5	Design and develop assembly language programs using 8085/86 instructi ons, soft ware interrupts, subrouti nes, macros.

2.	Syllabus	
	INTRODUCTION TO MICROPROCESSOR EVOLUTION	**(02 Hours)**
	Introduction to Microprocessor and Development and its Operation.	
	ARCHITECTURE FEATURES OF 8085	**(03 Hours)**
	8085 Architecture and Pin out diagram, 8085 Operations.	
	INTRODUCTION SET AND PROGRAMMING OF 8085	**(06 Hours)**
	Data Transfer instructi ons, Arithmeti c instructi ons and its examples, Logical Instructi ons and its examples, Branch, Stack, and I/O related instructi ons, How to write, assemble and execute assembly language programmes, Assembly language programming Practi ce Based on above instructi ons for 8085, Design Counters in 8085, Design Time delays in 8085, Stack & Subrouti nes: Restart, Conditi onal and Unconditi onal Call and Return Instructi ons, Advanced Subroutine Concepts, Code Conversion, 16-bit Data Operation.	
	PERIPHERAL & MEMORY INTERFACING WITH 8085	**(08 Hours)**
	Basic I/O Interfacing Concepts: Interfacing Display devices, Interfacing Input devices, Memory Interfacing: Absolute decoding, Parti al Decoding, Shadow Memory, Interfacing Peripherals: 8255A Programmable Peripheral Interface, Examples of Interfacing Keyboard and seven-segment Display, Examples of Bidirecti onal Data transfer Between Two Microcomputer, The 8254 (8253) Programmable Interval Timer, The 8259A Programmable Interrupt Controller, Direct Memory Access and 8237 DMA Controller, The 8279 Programmable Keyboard/Display Interface, Interfacing Scanned Multi plexed Displays and Liquid Crystal Displays, Interfacing a Matrix Keyboard, Serial I/O and Data Communicati on: Basic concepts in Serial I/O,	

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	Software Controlled Asynchronous Serial I/O, The 8085-Serial I/O lines: SOD and SID, Hardware Controlled Serial I/O Using Programmable Chips.	
	8085 INTERRUPT MANAGEMENT	**(04 Hours)**
	Interrupts and its Types in 8085, Interrupt Vector Table, Priority of Interrupts, Programming using Interrupts.	
	8086 ARCHITECTURE	**(03 Hours)**
	8086 Architecture, Pin Out Diagram and its Features, Registers of 8086.	
	INSTRUCTION SET OF 8086	**(06 Hour)**
	Data Transfer Instructi ons and Examples based on it, Arithmeti c Instructi ons and Examples based on it, Logical Instructi ons, Comparison Instructi ons, Jump Instructi ons, Examples based on Logical, Comparison, Jump Instructi ons, Various 8086 Assembler Directives, Examples based on Various Assembler Directi ves, What are Procedures in 8086?, Procedure-based Examples in 8086, What are Macros in 8086? Macros-based Examples in 8086.	
	PERIPHERAL & MEMORY INTERFACING WITH 8086	**(04 Hour)**
	Interfacing Peripherals:- 8255A: Examples of Interfacing Keyboard and Seven-segment Display, Interfacing with Alphanumeric Displays, Examples of Bidirecti onal Data Transfer Between Two Microcomputer, 8254, 8259A, and 8279 Interfacing with 8086.	
	8086 INTERRUPTS MANAGEMENT AND APPLICATIONS	**(03 Hour)**
	8086 Interrupts and Interrupts Responses, Interrupt Pointer Table, Hardware Interrupt, Software Interrupts, Interrupt Applications.	
	RECENT TRENDS IN MICROPROCESSORS	**(03 Hour)**
	Practicals will be based on the coverage of the above topics.	**(30 Hours)**
		(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**Practicals:**
1	Introduction of 8085 kit and Installati on 0f 8085 simulator
2	Assembly Language Programming based on Data transfer and Arithmetic and Logic instructions
3	Assembly Language Programming based on Branch operations
4	Assembly Language Programming based on stack and subroutines
5	Assembly Language Programming based on Code conversions

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6	Assembly Language Programming based on counter and time delays
7	Introduction of 8086 Microprocessor and Installati on of TASM, TLINK, TD, and DEBUG
8	Assembly Language Programming based on 8086 instructi on and assembler directi ves
9	Practical based on 8085 interfacing

4. Books Recommended:

1. Senti lkumar N, Saravanan M and Jeevananthan S, "Microprocessors and Microcontrollers" 2/E, Oxford University Press, 2018..
2. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applicati ons with 8085", 6/E, Penram Internati onal Publishing (India) Pvt. Ltd., 2013.
3. Douglas V Hall, "Microprocessors and Interfacing: Programming & Hardware", 3/E, TMH, 2013
4. Brey, "The Intel Microprocessors", 8/E, Pearson Educati on, 2009.Andrew Ilachinski, "Cellular Automata", 1st Ed., World Scientific, 2001.
5. A K Ray and K M Bhurchandi, "Advanced Microprocessors & Peripherals: Architecture Programming & Interfacing", 2/E, TMH, 2006.

ADDITIONAL REFERENCE BOOKS

1. Abel Peter and Nizamuddin, "IBM PC Assembly Language and Programming", 5/E, Pearson Education, 2001.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat

Department of Artificial Intelligence

B.Tech. Artificial Intelligence

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)