Bansilal Ramnath Agarwal Charitable Trust’s

Vishwakarma Institute of Technology
(An Autonomous Institute affiliated to University of Pune)

Structure & Syllabus of

B.Tech. (Computer Engineering)

Pattern ‘A-14’
Effective from Academic Year 2015-16

Prepared by: - Board of Studies in Computer Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS    Chairman – Academic Board
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7 Course Structure - Module V

8 Course Syllabi for Courses - Module V

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11. **Course Structure - Module VII**

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### Course Structure - Module VIII

**12.4 ** Elective Group II (Theory Course)
- CS42125: Randomized and Approximation Algorithms
- CS42113: Digital Signal Processing
- CS42119: Information Retrieval
- CS42114: Product Design
- CS42115: Human Computer Interaction
- CS42134: Modeling and Simulation

**12.5 ** CS40115: Distributed Computing (Tutorial Course)

**12.6 ** Elective Group II (Tutorial Course)
- CS42125: Randomized and Approximation Algorithms
- CS42113: Digital Signal Processing
- CS42119: Information Retrieval
- CS42114: Product Design
- CS42115: Human Computer Interaction
- CS42134: Modeling and Simulation

**12.7 ** CS40314: Business Intelligence and Analytics (Laboratory Course)

**12.8 ** Elective Group I (Laboratory Course)
- CS42305: Mobile Computing
- CS42331: Enterprise Systems
- CS42327: Cloud Computing
- CS42303: Parallel Computing on GPU
- CS42332: Network Security
- CS42301: Advanced Computer Graphics

**12.9 ** CS47303: Project Stage - II

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### Course Syllabi for Courses - Module VIII

**14.1 ** CS40106: Compiler Design (Theory Course)

**14.2 ** CS40110: Artificial Intelligence (Theory Course)

**14.3 **
- CS42120: Data Mining

**13 ** Course Structure - Module VIII

**14 ** Course Syllabi for Courses - Module VIII
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**Elective Group IV (Theory Course)**

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<td>CS42116</td>
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**Elective Group III (Tutorial)**

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**Elective Group IV (Tutorial)**

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**Project Stage - III**

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**Course Syllabi for PD Courses in TY B.Tech (Computer Engineering)**

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<td>PIC Microcontroller</td>
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<td>Mobile Application Development</td>
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### Program Educational Objectives (PEO)

**B.Tech (Computer Engineering)**

List of Programme Education Objectives [PEO] and Programme Outcomes [PO]

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<th>PEO Statement</th>
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<td>PE01</td>
<td>Preparation</td>
<td>To prepare the students as a committed technology workforce by providing them global educational platform with innovative practices resulting in computing artifacts realization</td>
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<tr>
<td>PE02</td>
<td>Core competence</td>
<td>To impart adequate mathematical and computing theory knowledge basis leading to sustainable computer engineering solutions development</td>
</tr>
<tr>
<td>PE03</td>
<td>Breadth</td>
<td>To inculcate problem solving skills and engineering practices in students adhering to well-formed technical specifications and constraints with the help of sound methods, tools and techniques</td>
</tr>
<tr>
<td>PE04</td>
<td>Professionalism</td>
<td>To instill in the students professional and ethical practices by following effective guidelines to acquire aptitude, attitude and desire beneficial in societal context</td>
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<tr>
<td>PE05</td>
<td>Learning Environment</td>
<td>To promote aspiring students for continuing education, engineering certifications and entrepreneurship in emerging areas of computing</td>
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List of Programme Outcomes [PO]

Graduates will be able

<table>
<thead>
<tr>
<th>PO</th>
<th>Graduate Attributes</th>
<th>PO Statement</th>
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</table>
| P01 | GA: 1 Engineering Knowledge | 1. To apply scientific, mathematical and computing fundamentals in order to devise engineering solution for real world problems.  
2. To apply computer theory and algorithmic principles to innovatively craft solutions by context and development. |
| P02 | GA: 2 Problem Analysis | 3. To discover and infer computing problem situations, resulting in physical model, mathematical model or graphical model depicting the overall problem.  
4. To systematize functional specifications of target computing environment by adequate consideration of technology infrastructure, boundary conditions and constraints. |
| P03 | GA: 3: Design/Development of solution | 5. To conceive well-formed design specifications and constructs demonstrating correct compositional system structure with implementation-centric considerations.  
6. To incorporate architectural styles and design patterns to assimilate new facts, information and ideas about the design. |
| P04 | GA: 4: Conduct Investigation of Complex Problem | 7. To interpret reference data and program pragmatics for analyzable experimental results derivation.  
8. To judge and relate complexity issues and levels by making use of standardized verification and validation techniques. |
| P05 | GA: 5: Modern Tool Usage | 9. To operationalize and utilize the state-of-the-art CASE tools for engineering artifacts construction.  
10. To correlate and hypothesize problems for recognizing new or unfamiliar problem patterns. |
| P06 | GA: 6: The Engineer and Society | 11. To minimize adverse effects on the environment for their own and succeeding generations by respecting published facts and guidelines. |
| P07 | GA: 7: Environment and sustainability | 12. To consider the impact and benefits of engineering achievements in exploitation and management of technology on environment and society. |
| P08 | GA: 8: Ethics | 13. To prepare and present engineering evidence, theory and interpretations honestly, accurately and without bias. |
| P09 | GA: 9: Individual and Team Work | 14. To demonstrate high standards of professional conduct, openness and fairness by maintaining due respect towards rights and reputation of team members and development organization. |
| P10 | GA: 10: Communication | 15. To demonstrate deep listening, learning, leadership and managerial skills to solve complex engineering problems in teams. |
| P11 | GA: 11: Lifelong Learning | 16. To become part of a valuable body of knowledge in competitive computing areas.  
17. To acquire responsible positions in government, industry and society by continuously learning and researching. |
<table>
<thead>
<tr>
<th>PO12</th>
<th><strong>GA: 12:</strong> Project Management and Finance</th>
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<tr>
<td></td>
<td>18. To creatively devise and incorporate project-specific processes supported by rigorous standards applicable to professional engineering bodies.</td>
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### Module 1

<table>
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<th>Subject</th>
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## Module 2

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### F.Y. B. Tech. Structure with effect from Academic Year 2015-16

#### Semester I – Irrespective of Module

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**TOTAL** - 8 - 4
### F.Y. B. Tech. Structure with effect from Academic Year 2015-16

**Semester II – Irrespective of Module**

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<td>20</td>
<td>HS15333</td>
<td>Numerology</td>
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CS10102:: COMPUTER PROGRAMMING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: (8+2 Hrs)


Unit 2: (8+2 Hrs)


Arrays: Concept, declaration and initialization of arrays, accessing individual elements of array. Use of arrays in sorting, searching. Concept of 2-D array (Matrix), row major and column major representation of array, address calculation for accessing the individual element.

Part B: Static variables and constants in C language.

Unit 3: (8+2 Hrs)


Part B: Preprocessor and preprocessor directives: macro substitution, difference between macro and functions.

Unit 4: (8+2 Hrs)
Part A:


Strings: Strings as arrays, character array versus strings, reading strings, writing strings, user defined functions for string operations – copy, concatenate, length, reverse, converting case, appending, comparing two string, extracting a substring. Array of strings.

Part B: Const keyword in C, standard string library functions in string.h for string manipulation.

Unit 5: (8+2 Hrs)
Part A: Structures: Notion, declaration and initialization, structure variables, accessing and assigning values of the fields, "size of" operator, functions and structures, arrays of structures, nested structures, pointers and structures, passing structure to a function and returning structure from function. Dynamic memory allocation, type casting, Introduction to self referential structures, linked list as a dynamic alternative to arrays.

File Handling in C: file types, file opening modes, file handling I/O – fprintf, fscanf, fwrite, fread, fseek. File pointers. Implementing basic file operations in C.


Text Books

Reference Books

Additional Reading
Course Outcomes:

Upon completion of the course, graduates will be able to -

1. List procedural programming benefits to construct concise solutions
2. Interpret and develop naturo-visual representation of problem in hand.
3. Apply available algorithmic principles to general efficient solutions
4. Justify modular programming approach by making use of elementary as well as superior data structures.
5. Apply programming fundamentals with generic prototype.
6. Evaluate and manipulate given solutions in reengineered view
CS10302:: COMPUTER PROGRAMMING LAB

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practicals

1. Study of most important DOS/UNIX commands.

2. Write a program in C to find largest element / average of given N elements / sum / reverse of a given integer.

3. Write a program in C to implement a simple mathematical calculator

4. Write a program in C to read an integer and display each of the digits of an integer in English.

5. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

6. Write a program in C to perform Addition / Subtraction / Multiplication of two Matrices. Also determine whether the matrix is symmetric / skewed.

7. Write a program in C to carry out following operations on strings using string library Functions:
   a. Length of a string.
   b. Copy a string.
   c. Concatenation of strings.

8. Write a program in C to carry out following operations on strings without using string library functions
   a. Compare two strings.
   b. Reverse given string.
   c. To check if the given string is a palindrome or not.

9. Write a program in C to carry out following operations on strings using pointers.
   a. Length of a string.
   b. Concatenation of strings.
   c. Copy of string
   d. Compare two strings.

10. Write a C program that works with complex numbers using a structure. Perform the following operations:
    a. Reading a complex number.
b. Addition of two complex numbers.
c. Writing a complex number.
d. Multiplication of two complex numbers.

11. Write a C program to create a database of students by using array of structure and perform following operations on it.
a. Accept/modify record of student
b. Search a particular record
c. Display all records

12. Write a program in C that use both recursive and non-recursive functions to find the Factorial / GCD (greatest common divisor) of two given integers / Fibonacci series.

13. Write a program in C to sort n integers using bubble / merge sort.

14. Write a program in C to search a number in a given list using linear / binary search.

Text Books

Reference Books

Additional Reading
### Module III

**S.Y. B. Tech. Structure with effect from Academic Year 2015-16**

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#LAB₃ | General Seminar – 2 | LAB₃ | | | 70 | 30 | 1
CS20401 | Comprehensive Viva Voce | CVV₁ | | | 2

TOTAL 16 14 2

# Students will register only in Semester IV irrespective of Module * Students will register only in Semester III irrespective of Module
CS20117: DISCRETE STRUCTURES AND GRAPH THEORY

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Elementary knowledge of 1) Numbers 2) Probability

Unit 1 (Logic and Proofs) (8 hrs)

Part A:
Propositional logic, propositional equivalences, predicates and quantifiers, rules of inference, introduction to proofs- direct, trivial, contraposition, contradiction, counterexamples; Normal forms – DNF and CNF.

Part B: Program Correctness

Unit 2 (Elementary Discrete Structures & Basic Counting) (8 hrs)

Part A:
Elementary set theory, relations, functions, principle of mathematical induction, basic counting principles, permutations, combinations, generalized permutations and combinations (with/without repetitions), Permutations with indistinguishable objects, Binomial coefficients and identities.

Part B:
Generalized permutations and combinations (distinguishable/indistinguishable objects)

Unit 3 (Advanced Counting Techniques) (8 hrs)

Part A:
Pigeon-Hole Principle : Some elegant applications, Inclusion Exclusion Principle : Counting with Venn Diagrams, (some examples from counting Derangements, number of primes upto n, number of onto functions, Euler’s phi function), Recurrence relations, modeling using recurrence relations (some examples from: Fibonacci numbers, Catlan numbers, Derangements, Tower of Hanoi), solution of linear recurrence relations with constant coefficients (homogenous and non-homogenous), generating functions and coefficients.

Part B:
Turan’s generalization of Mantel’s theorem, Mobius inversion formula and some applications.
Unit 4 (Modular Arithmetic)  

Part A.

Number theory – Division Algorithm, Euclid’s Algorithm, extended Euclid’s algorithm, modular inversion, Fundamental Theorem of Arithmetic, Congruence’s, Fermat’s little theorem, Euler’s phi function, Chinese remainder theorem, Diffie-Hellman and RSA algorithms.

Part B: Fast exponentiation

Unit 5 (Graph Theory)  

Part A:

Graphs, different representations, properties of incidence and adjacency matrices, directed/undirected graphs, connected components, degree of a vertex, paths, cycles in graph, Euler and Hamiltonian tours/graphs, Trees, bipartite graphs (graph with only odd cycles, 2-colorable graphs), Planar graphs, Theorem on bound on number of edges, Graph colorings

Part B:

Hall’s marriage theorem, perfect matching’s in graph, Tutte’s theorem, Konig’s theorem,

Text Books:

1. Discrete Mathematics and its applications by Kenneth Rosen (William C Brown Publisher)
2. Applied Combinatorics by Alan Tucker (Wiley Publishing company)
3. Combinatorics: Topics, techniques, algorithms by Peter J. Cameron (Cambridge University Press)
4. Graph Theory by Reinhard Diestel (Springer Verlag Publishing Company)
5. Introduction to Graph Theory by Douglas B. West (Prentice-Hall publishers)
7. ‘Elementary Number Theory’, David Burton

Reference Books:

2. Algebra by Michael Artin (Pearson Prentice Hall)

**Course Outcomes:**

Upon completion of the course, graduates will be able to –

1) **Reason** mathematically about elementary discrete structures (such as functions, relations, sets, graphs, and trees) used in computer algorithms and systems
2) **Describe** the elementary properties of modular arithmetic and their applications in Computer Science like cryptography.
3) **Summarize** graph theory fundamentals and their applications
4) **Develop** recurrence relations for a wide variety of interesting problems
5) **Express** mathematical properties via the formal language of propositional and predicate logic
6) **Demonstrate** use of pigeon-hole and inclusion-exclusion principle in solving elegant and important problems
CS20111: Data Structures

Credits: 03
Prerequisites:

Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: Fundamentals of Data Structures, Sorting & Searching (8 Hrs)

Part A

Part B: External Sorting, Sparse Matrix: Addition and Fast transpose

Unit 2: Elementary Data Structures (8 Hrs)

Part A

Part B: Priority Queue

Unit 3: Linked Lists (8 Hrs)

Part A
Singly Linked Lists, Doubly linked Lists, Circular liked lists, Generalized linked lists, Applications: Stack & Queue using linked list, Polynomial Manipulation using linked list & Generalized linked list.

Part B: Dynamic memory allocation for matrices and operations on matrices, Sparse matrix representation

Unit 4: Trees (8 Hrs)

Part A
Basic terminology, representation using array and linked list, Tree Traversals: Recursive and Non recursive, Operations on binary tree: Finding Height, Leaf nodes, counting no of nodes etc., Construction of binary tree from traversals, Binary Search trees (BST): Insertion, deletion of a node from BST, Optimal Binary Search tree (OBST), Threaded Binary tree (TBT): Creation and traversals on TBT, Height Balanced Tree (AVL): Rotations on AVL tree, M-way search trees: Btrees, B* tree
Part B: Red-Black Trees, Game trees, Expression tree

Unit 5: Graph (8 Hrs)

Part A
Terminology and representation, Traversals, Connected components and Spanning trees: Prim’s and Kruskal’s Algorithm, Shortest Paths and Transitive Closures: Single Source all destinations (Dijkstra’s Algorithm), All pair Shortest Path Algorithm, Activity Network, Topological Sort and Critical Path

Part B: Multistage Graphs

Text Books:

Reference Books:

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. To interpret and diagnose the properties of data structures with their memory representations.
2. Handle operations like searching, insertion, deletion, traversing mechanism etc. on data structures like stack and Queue.
3. Use linear and nonlinear data structures like stacks, queues, linked list etc
4. Demonstrate the use of tree and its applications.
5. Analyze the real world problems using Graph Data Structure.
6. Apply an appropriate data structure and algorithm to solve a problem.
CS20108:: COMPUTER ORGANIZATION

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: Structure of a Computer System (8 Hrs)


Part B: PCI Bus. IEEE standards for Floating point representations (Double Precision Format).

Unit 2: Processor Organization (CPU) (8 Hrs)


Part B: Introduction to i7 processor.

Unit 3: Control Unit (8 Hrs)


Part B: Multiple-bus organization. Applications of micro programming.

Unit 4: Memory Organization (8 Hrs)


Part B: Secondary Storage: Magnetic Disk, Optical memory, CDROM, RAID

Unit 5: Advanced Computer Organizations (8 Hrs)

Part A: The Intel IA-64 Architecture: General Organization, Prediction, Speculation Software pipelining, Instruction set architecture. Introduction to parallel processing: Trends towards parallel processing, architectural classification schemes (Flynn’s classification) Introduction to multicore processor AMD/ NVIDIA GPU architecture.

Part B: Itanium Organization

Text Books

Reference Books

Course Outcomes:
Upon completion of the course, graduates will be able to -

<p>| | |</p>
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<td>1</td>
<td>Operationalize arithmetic and control unit based on computer architectures.</td>
</tr>
<tr>
<td>2</td>
<td>Analyze impact of circuit-driven and program-driven analogies to assemble realizable solutions.</td>
</tr>
<tr>
<td>3</td>
<td>Design processor and memory with due consideration to tradeoffs and performance issues.</td>
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<tr>
<td>4</td>
<td>Suggest performance-bound solutions in order to demonstrate variety of technologies.</td>
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<tr>
<td>5</td>
<td>Recognize historical scenario of computing unit’s development with regards to technological evolution.</td>
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<tr>
<td>6</td>
<td>Illustrate organization of digital computers with basic principles and operations of its components.</td>
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CS20116:: PROBLEM SOLVING AND PROGRAMMING

Credits: 02  
Teaching Scheme: - Theory 2 Hrs/Week

Prerequisites: Computer Programming

Unit 1 Introduction 
(6+1 Hrs)

Part A:

General Problem solving techniques: Examples of problems that are solved using different approaches: ask questions, look for things that are familiar, solve by analogy, means-ends analysis, divide and conquer (top-down approach or stepwise refinement), building block approach, merging solutions, working backwards from a solution, binary doubling strategy, iterative vs recursive solutions, parallel techniques

Program Verification: computer model for program execution, correctness of programs, input and output assertions, implication and symbolic execution, verification of different types of program segments – straight line program segment, having branch, having loops, loop invariants, using arrays. Proof of termination. Debugging programs and program testing. The challenge of Binary Search.

Efficiency of programs: considerations during design, considerations during implementation, reducing time and space requirements of programs, choosing right data structures and data types – arrays, lists, tables, bitmaps. When to use what?

Part B. Input validation – GIGO, input validation loop, defensive programming

Unit 2: Basic Algorithms for Integers 
(6+1 Hrs)

Part A:

Fundamental Algorithms – exchanging values of two variables, generating Fibonacci sequence, reversing digits of an integer, base conversion, character to number conversion

Factoring Methods: finding square root of a number, finding GCD of two numbers, generation of pseudo random numbers, generating prime numbers, finding prime factors of an integer, raising a number to a large power.

Part B. Simple modular arithmetic - last k digits of number a^b, finding recurring decimal expansion for rational number a/b
Unit 3: Numerical Methods (6+1 Hrs)

Part A.


Part B. Simpson’s rule, Trapezoidal rule

Unit 4: Recursion and Arrays (6+1 Hrs)

Part A.


Array Techniques: array order reversals, removal of duplicates from an ordered array, partitioning an array, finding the kth smallest element, largest monotone subsequence. Using parallel arrays and higher dimensional arrays. Algebraic equations - Gaussian elimination

Part B. 8 queens problem, Gauss-Siedel method

Unit 5 Text Processing (6+1 Hrs)

Part A.

String processing and pattern searching: text line length adjustment, left and right justification of text, keyword searching in text, text line editing, linear pattern search, sublinear pattern search, character-by-character text processing. Some standard text processing problems.

Part B. Big number arithmetic using strings for representing numbers – for example multiplying 100 digit numbers or finding factorial of 100

Text Books


2. “How to Solve It by Computer”, R. G. Dromey, PHI
3. “Starting out with programming logic and design”, 3rd edition, Tony Gaddis, Pearson publications
4. “Programming Logic and Design Introductory”, sixth edition, Joyce, Farrell, Course Technology, CENGAGE Learning
5. “An Introduction to programming through C++”, Abhiram Ranade, McGraw Hill Education

Reference Books

Course Outcomes:

Upon completion of the course, graduates will be able to -

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Apply logical ability to solve the problems using suitable technique.</td>
</tr>
<tr>
<td>2</td>
<td>Construct various algorithms based on different data types using fundamental and factoring methods</td>
</tr>
<tr>
<td>3</td>
<td>Develop programming methods to solve various numerical and differential equations.</td>
</tr>
<tr>
<td>4</td>
<td>Solve problems using recursive and iterative techniques.</td>
</tr>
<tr>
<td>5</td>
<td>Implement robust programming solutions for problems such as string processing and pattern searching</td>
</tr>
<tr>
<td>6</td>
<td>Select appropriate programming paradigm, data structures and algorithm to solve complex computing problem.</td>
</tr>
</tbody>
</table>
CS20113:: DIGITAL ELECTRONICS AND LOGIC DESIGN

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: Number system and Codes (8+1 Hrs)
Part B. Minimization of POS forms using K-Map, Quine-McCluskey Method, Half adder and subtractor, full adder and subtractor.

Unit 2: Combinational & Sequential logic circuits (9+1 Hrs)
Part B: ALU 74181, BCD-to-7-segment Decoder, adder with look ahead carry generator.

Unit 3: Design of sequential circuits (8+1 Hrs)
Part A: Moore/Mealy M/c's: representation techniques, state diagrams, state tables, state reduction, state assignment, implementation using flip-flops. Applications like sequence generator and detector. Shift register (modes of operation), 4 bit bi-directional universal shift register, application of shift registers (Ring counter, Sequence generator, Johnson's counter.)ASM charts, notations, design of simple controller, multiplexer controller method, RTL notations and implementation.
Part B. Examples on ASM, RTL.

Unit 4: Logic Families (8+1 Hrs)
Part A. Characteristics of Digital ICs: Speed, Power dissipation, fan-out, current and voltage parameters, noise margin, operating temperature etc., TTL: Operation of TTL NAND gate, Standard TTL, TTL Characteristics, Active pull-up, Wired-AND, totem pole, open collector, Unconnected Inputs. CMOS Logic: CMOS Inverter, CMOS NAND and NOR, CMOS characteristics. Wired-logic, Unconnected Inputs, Open-Drain Outputs, Comparison of TTL and CMOS, interfacing TTL to CMOS

Part B. Interfacing CMOS to TTL, Tri-state logic: tri-state buffers, inverters, Study of Data sheets of 7400 Series ICs: (Basic and Universal logic gates)

Unit 5: Programmable Logic Devices (8+1 Hrs)
Part A: Programmable Logic array: Input, Output Buffers, AND, OR, Invert/Non-Invert Matrix, Programming the PLA, Applications of PLAs to implement combinational and sequential logic circuits Introduction to :FPGA, CPLD. Introduction to VHDL: Modeling Digital systems, modeling languages, modeling concepts.

Part B: Comparison of FPGA and CPLD, VHDL Programs.

Text Books

Reference Books

Course Outcomes:

Upon completion of the course, graduates will be able to -

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Optimize logical equations using reduction techniques</td>
</tr>
<tr>
<td>2</td>
<td>Design different types of code convertors</td>
</tr>
<tr>
<td>3</td>
<td>Construct Combinational and Sequential circuits</td>
</tr>
<tr>
<td>4</td>
<td>Validate the internal structure of combinational circuits</td>
</tr>
<tr>
<td>5</td>
<td>Develop applications of sequential circuits</td>
</tr>
<tr>
<td>6</td>
<td>Describe Programmable Logic Devices</td>
</tr>
</tbody>
</table>
CS20216:: PROBLEM SOLVING AND PROGRAMMING

Credits: 01  

Teaching Scheme: -Tutorial 1Hr/Week

Prerequisites: Computer Programming

List of Contents

A TERM-WORK containing the record of the following:

1. Implementing logic to draw basic shapes on computer using some library to take care of drawing details (basic shapes like square, circle, polygons etc., basic animation, projectile motion, bouncing ball etc.)
2. Visualizing simulations (e.g. cosmological simulation) using a library to take care of drawing details
3. Modular arithmetic (finding last k digits of number a^b, finding recurring decimal expansion for rational number a/b, etc.)
4. Factoring methods (generation of pseudo random numbers, smallest divisor of an integer, computing n\textsuperscript{th} Fibonacci number, etc.)
5. Taylor Series expansion (with an emphasis on program specification, testing, proof of correctness, invariants, debugging, good coding practices) taking sine, cosine, e etc. as examples
6. Applications of recursion (drawing recursive pictures, layout of mathematical formulae, finding min-max, etc.)
7. Array based techniques (Gaussian elimination, Gauss-Siedel method, etc.)
8. Text processing and pattern searching (finding LCS in strings, finding duplicate words, spell checker, etc.)

Text Books
2. “How to Solve It by Computer”, R. G. Dromey, PHI
3. “Starting out with programming logic and design”, 3rd edition, Tony Gaddis, Pearson publications
4. “Programming Logic and Design Introductory”, sixth edition, Joyce, Farrell, Course Technology, CENGAGE Learning
5. “An Introduction to programming through C++”, Abhiram Ranade, McGraw Hill Education
Reference Books
CS20113: DIGITAL ELECTRONICS AND LOGIC DESIGN

Credits: 01
Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites:

List of Contents

1. Introduction to electronic workbench, solving 2-3 combinational examples.
2. Introduction to 74XX, 54XX ICs and basic component of logic family
3. Diode as a switch.
4. Design logic gates using diodes.
5. Introduction to basic component of logic family-Transistor.
6. Characteristics and configuration of Transistor.
7. Transistor as a switch
8. Design logic gates using Transistor
9. Introduction to basic component of logic family-MOSFET
10. Study of voltage and current characteristics of digital ICs.
11. Design of state transition diagram using ASM.
12. Design of datapath and control path using RTL. (Two examples)

Text Books

Reference Books

Additional Reading
CS20311: DATA STRUCTURES

Credits: 02
Teaching Scheme: Laboratory 4 Hrs/Week
Prerequisites: Computer Programming

List of Lab Experiments

1. Implementation Quick and Merge Sort.
2. Implementation of Heap Sort
4. Simulation of Recursion using STACK.
5. Implementation of Expression conversion and Evaluation.
6. Simulation of Job Scheduling Using Queue
7. Polynomial Manipulation using Queue
8. Implementation of various operations on singly linked list.
9. Implement Generalized linked list and various operations on it.
10. Implement various operations on Doubly Linked list.
11. Implement various operations on Binary Search tree.
13. Implement Btree, B+ tree and operation on it.
15. Implement BFS, DFS on Graph.
16. Implement Prim’s and Kruskal’s Algorithm.
17. Implement Dijkstra’s algorithm
18. Implement all pair shortest path problem.

Text Books:


Reference Books:

CS20313:: DIGITAL ELECTRONICS

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practical

I Combinational Logic Design
1. Verification of Logical Gates and Boolean Algebra.

2. Code converters, e.g. Excess-3 to BCD and vice versa using logical gates.

3. Multiplexer - e.g. 16:1 Mux using 4:1 Mux (IC 74153).

4. Decoder – e.g. 2 bit comparator (IC 74138).

5. BCD adder –using IC 7483

II Sequential Circuit Design (Any six)
1. Conversion of flip-flops. e.g. JK to D, T.

2. Ripple (asynchronous) mod –N counter using J-K F-F.

3. Ripple (asynchronous) mod –N counter using IC 7490.


5. Sequence generator using JK flip-flop

6. Pseudo random number generator using 74194.(universal shift register)

7. Sequence detector (Moore ckt) using JK flip-flop
8. Sequence detector (Mealy ckt) using JK flip-flop

III ASM (Any one)
2. Design of simple combinational circuit: half adder and subtractor using VHDL language.

Text Books

Reference Books

Additional Reading
CS27401: MINIPROJECT

Credits: 02

Guidelines:
The Student has to select a project in group based on a topic of interest from any of the subjects offered in current Semester. Periodically the implementation will be evaluated by the guide.

Evaluation is done in two stages. In the first review the internal Guide evaluates the project against 40% of the implementation of work. At the end of semester each group will be evaluated by externally Guide from Industry based on their Presentation, completeness of Project implementation and report artifact.

Course Outcomes
Upon completion of the course, graduates will be able to -
1. Recognize essential & dominant area of technology for achievable artifacts over rapid period of time.
2. Acquire rapid application development cycle involving prototyping to learn adequate technological environments.
3. Concisely formulate specific problem in drafted specification format.
4. Devise data dictionaries and solution design with sufficient details.
5. Demonstrate the crafted solutions to user community with a lean learning curve.
6. Validate newer dimension of extendable and scalable nature of the problem solution crafting.
CS24306 PHP MYSQL

Credits: 01

Teaching Scheme: Lab 2 Hours / Week

List of Practical’s:

1. Download, Install and Configure Netbeans IDE 8.x/eclipse with XAMPP/WAMP/IIS/Tomcat 6.x and MySQL server for PHP
2. Design a Web page using HTML5 and CSS.
3. Design a PHP page to demonstrate the use of variables, functions, conditional and looping constructs.
4. Design a Web form using PHP and apply validation.
5. Design a Web page to demonstrate the use of session and cookie.
6. Implement user defined exception handling for the Web page.
7. Design a database application in PHP using MySQL.
8. Design a client agent to send an email in PHP
9. Design File upload and download program in PHP
10. Design Web page filters in PHP
11. Design Web page using AJAX and PHP
12. Mini project

Text Books:

Reference Books:

Course Outcomes:
Upon completion of the course, graduates will be able to –

1. Use MySQL database, Flat files
2. Create user defined exceptions, page filters, session and cookie
3. apply the effects of HTML5,CSS,AJAX
4. Choose suitable software tools for Web Development Application
5. Design and deploy dynamic and interactive web pages.
6. Demonstrate the Model-View-Control design pattern for Web Application.
CS24303: C#.NET

Credits: 01  
Teaching Scheme: - Lab 2 Hrs/Week  
Prerequisites: C programming

List of Practical
2. Implementing Arrays, Strings and System collections in C#.
3. Implementing Classes, objects, constructors in C#  
4. Design a simple C#.net application for calculator.  
5. Design a simple C#.net application for notepad/word pad using menu editor.  
6. Handling multiple forms in C#.  
7. Design Database application.  
9. File handling and Exception Handling in C#  
10. Publishing and Deployment of windows application in C#.net/Developing DLLs  
11. Mini project.

Text Books

Reference Books

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Display proficiency in C# programming by building stand-alone applications in the .NET framework.
2. Analyze Common Language Runtime (CLR), garbage collection, and assemblies, forms, collections, constructs, delegates, events and exception handling.
3. Create data-driven applications using the .NET Framework, C# and ADO.NET
4. Design application and projects using Visual Studio IDE.
5. Evaluate problems and alternative solutions using C# in a wide variety of business and organizational contexts in different socio-cultural environments.
# S.Y. B. Tech. Structure with effect from Academic Year 2015-16

## Module IV

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credits</th>
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<td>S₁</td>
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<td>Principles of Programming Languages</td>
<td>S₃</td>
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<td>CS21112</td>
<td>Data Communication</td>
<td>S₄</td>
<td>2</td>
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<td>*CS20113</td>
<td>Digital Electronics and Logic Design</td>
<td>S₅</td>
<td>3</td>
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<td>#CS20114</td>
<td>Microprocessor and Interfacing</td>
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<td>CS20310</td>
<td>Computer Graphics</td>
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<td>CS20305</td>
<td>Principles of Programming Languages</td>
<td>P₂</td>
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* * * CS20113
# CS20114
## Structure and syllabus of S.Y. B.Tech Computer Engineering Pattern A-14, A.Y. 2015-16

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<th>Theory</th>
<th>Practical</th>
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<tr>
<td>CS20313</td>
<td>Digital Electronics Microprocessor and Interfacing</td>
<td>MP3</td>
<td>4</td>
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<tr>
<td>CS20314</td>
<td>Microprocessor and Interfacing</td>
<td>SD3</td>
<td>2</td>
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<tr>
<td>CS27402</td>
<td>Mini Project</td>
<td>LAB3</td>
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<td>CS24302</td>
<td>ASP.net OR Python Ruby Programming</td>
<td>LAB3</td>
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<td>CS24304</td>
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<td>CS24307</td>
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<td>*LAB4</td>
<td>Technical Writing</td>
<td>LAB3</td>
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<tr>
<td>CS20401</td>
<td>Comprehensive Viva Voce</td>
<td>CVV1</td>
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</tbody>
</table>

**TOTAL** 16 14 2 25

* Students will register only in Semester III irrespective of Module

# Students will register only in Semester IV irrespective of Module
CS21104:: MATHEMATICAL TRANSFORMS AND APPLICATIONS

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Engineering Mathematics- I and Engineering Mathematics - II

Unit 1:  
Linear Differential equations of higher order  
(08 Hrs)


Part B. Electrical circuits and Coupled circuits

Unit 2:  
Complex Analysis  
(08 Hrs)

Part A: Complex differentiation, Analytical functions, Cauchy-Riemann equations, Complex Integration, Cauchy’s Integral Theorem and formula, Residue Theorem and applications to Engineering Problems, Power series, Taylor series, Laurent series, Radius of convergence.

Part B: Bilinear Transformations and Conformal mapping.

Unit 3:  
Laplace Transform  
(08 Hrs)


Part B: Application of Laplace transform to simultaneous differential equations.

Unit 4:  
Fourier Transform  
(08 Hrs)
A. Introduction to signals and their properties, mathematical operations on signals, Complex Fourier series and frequency spectrum, Fourier integrals, Fourier cosine and sine transforms, Fourier transforms, properties of Fourier transform, Discrete Fourier transform, Properties.

B. Applications of FT and DFT

Unit 5: Z Transform


B. Difference equations by Z transform method.

Text Books

Reference Books
1. Michael D. Greenberg; Advanced Engineering Mathematics; Pearson Education Asia
2. Dennis G. Zill, Michael R. Cullen; Advanced Engineering Mathematics; Narosa Publishing House
4. Robert A. Gabel, Richard A. Roberts; Signals and linear systems; John Wiley & sons.

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Relate the indispensible importance of Mathematics in Engineering and symbiosis between both.
2. Summarize the concepts of mathematical transforms and their applications to various engineering problems
3. Develop the ability to solve linear differential equations with constant coefficients and apply it for analysis of electrical circuits.
4. Describe the basic concepts of complex differentiation and integration and their application in mathematical and engineering problems.
5. **Utilize** Z transform and its properties in solving difference equations and system analysis.

6. **Translate** a physical problem into a mathematical model and find solution of the model by selecting and applying suitable mathematical method.
CS20110::COMPUTER GRAPHICS

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: C programming

Unit 1 : Basic Concepts ( 8 +1 Hrs )


Mathematical foundations: Lines and line representations, Vectors, Intersection of lines, Normalized Device Coordinates.

Scan conversions: DDA and Bresenham’s line drawing algorithms and Bresenham and Midpoint circle drawing algorithms, Arcs and Sectors, Aliasing and Antialiasing, Character Generation techniques.

Part B: Display devices, Interactive devices, Data generating devices, Thick lines.

Unit 2 : Polygons and 2D Transformation ( 9+1 Hrs )


2D Transformations: Introduction, Basic transformations such as- Scaling, Rotation, Translation, Homogeneous coordinates for transformations, Other transformations like Reflection, Shearing Transformations, Transformations about an arbitrary point, Inverse transformations. Numerical problems on transformation.

Part B: Fence fill algorithm, Problems on 2D transformation.

Unit 3 : Segments and Clipping ( 9+1 Hrs )

Part A: Segment: Introduction, Segment table, Segment Creation, Closing, Delete and renaming, Image transformation, Display structures used for segment.


Part B: Liang-Barsky algorithm, Cyrus Beck algorithm.

Unit 4 : 3D Transformations and Projections ( 7+1 Hrs )

Part A: 3D Transformations: Introduction, 3D point representation, Left handed system, Right handed system, Basic 3D transformations- Scaling, Rotation, Translation, Matrix representation, Derivation of Rotation matrices along the main axis, Rotation about an arbitrary axis, Reflection transformation with respect to main axes.

Projection: Projection concept, parallel and perspective projections, Viewing parameters, 3D windowing and clipping.
Part B: Reflection transformation with respect to planes, Problems based on 3D transformations

**Unit 5 : Hidden Surfaces, Curves and Fractals** ( 7+1 Hrs )


Part B: Scan line algorithm for Depth Comparison, Fractal surfaces, CMY and HSV color model

**Text Books:**


**Reference Books:**


**Course Outcomes:**

Upon completion of the course, the graduates will be able to …

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<tbody>
<tr>
<td>1</td>
<td>Apply mathematics and computer programming to computer graphics applications and problem solutions.</td>
</tr>
<tr>
<td>2</td>
<td>Utilize algorithms to draw, fill and perform 2D transformations on basic geometrical shapes.</td>
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<tr>
<td>3</td>
<td>Construct animation based demonstrating system using segments and clipping algorithms.</td>
</tr>
<tr>
<td>4</td>
<td>Systematically identify and solve numerical problems of transformations and projections.</td>
</tr>
<tr>
<td>5</td>
<td>Interpret the curves, fractals and hidden surfaces for representation of interactive graphics systems.</td>
</tr>
<tr>
<td>6</td>
<td>Devise and frame new set of algorithmic principles for efficient solutions useful to computing community.</td>
</tr>
</tbody>
</table>
CS20105: PRINCIPLES OF PROGRAMMING LANGUAGES

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:
Programming language concepts (8+2 Hrs)

Concepts of Imperative Programming:
Variables: lvalue and rvalue. Memory leak, invalid pointer references. Types and type checking (strong vs weak, static vs dynamic). Binding, scope, local and global variables. Activation Records, Function Calls, Recursion, Parameter passing methods, Stack-Based Storage management. Heap based storage management.

Part B: Compilers and Interpreters. Just In Time interpreters.

Unit 2:
Object – Oriented Programming (Java-I)

Part B: Pointers in C++, Destructors in C++,

Unit 3: (8+1 Hrs)
Object – Oriented Programming (Java-II)

Part B: Exception Handling in C++, multiple inheritance in C++.

Unit 4: (8+2 Hrs)
Functional Programming using SCHEME
Part A: Introduction to lambda calculus. The Scheme programming Language: Atoms, Lists, lambda expressions. Functions as first class objects. Control structures, Recursion and continuations, operations on objects, basic input output, Exceptions and
Part B: Haskell

Unit 5: (8+2 Hrs)
Introduction to SCALA
Part B: Combining SCALA and JAVA.

Text Books:


Course Outcomes:

Upon completion of the course, graduates will be able to -

<table>
<thead>
<tr>
<th></th>
<th>Analyze real world problems based on their knowledge of various programming paradigms and utilize the appropriate one.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Design and develop software artifacts using best practices in programming.</td>
</tr>
<tr>
<td>3</td>
<td>Evaluate the given problem and develop solution using object oriented programming paradigm.</td>
</tr>
<tr>
<td>4</td>
<td>Create solutions to problems using Integrated Development Environments and modern software tools.</td>
</tr>
<tr>
<td>5</td>
<td>Utilize their knowledge of programming paradigms to continue learning newer programming languages and constructs.</td>
</tr>
<tr>
<td>6</td>
<td>Select and utilize appropriate programming constructs and paradigms to devise effective software solutions.</td>
</tr>
</tbody>
</table>
CS21112 :: DATA COMMUNICATION

Credits: 02  
Teaching Scheme: - Theory 2 Hrs/Week

Prerequisites:

Unit 1:  
Introduction to Electronic Communication


Unit 2:  
Modulation Techniques


Part B: FM vs. AM, FM vs. PM, AM vs. PM, Numerical based on AM, FM.

Unit 3:  
Multiplexing and Communication

Part A: Introduction, FDM, TDM, WDM, CDMA, Frequency modulation principles, sideband and modulation index. Pulse code modulation, Delta modulation, Adaptive delta modulation, Differential PCM, PAM,

Part B: Parallel transmission, serial transmission.

Unit 4:  
Digital Modulations


Part B: Cellular Telephone System, Examples on Encoding, decoding.
Unit 5: Transmission and Propagation


Part B: Transmission media wired and wireless, Microwave antenna.

Text Books

Reference Books

Additional Reading

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Enumerate basics of signals, multiplexing, modulation and transmission.
2. Apply modulation and multiplexing techniques to optimize the channel requirements.
3. Compute the bandwidth, throughput, channel efficiency for different multiplexing and modulation techniques.
4. Recommend encoding techniques for communication system.
5. Justify the modulation, encoding and multiplexing techniques for specified communication system.
6. Evaluate the performance of network using error detection and correction methods.
CS20114:: MICROPROCESSOR AND INTERFACING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Digital Electronics and Logic Design.

Unit 1: (8+1 Hrs)
8086 Microprocessor

Part A: Introduction to 80x86 microprocessor, Internal Architecture, Generation of physical address, Minimum & Maximum Mode, Ready and Reset pin significance, study of 8086 supporting chips 8282(Latch), 8284(Clock Generator), 8286(Transceiver), 8288(Bus Controller). Timing Diagram Read Write Machine Cycles, Real Mode, General Purpose Instructions.

Part B: Instruction Set

Unit 2: (8+1 Hrs)
Assembly Language Programming & Interrupt Structure

Part A: Address Translation, Addressing Modes, Introduction to Assembly Language Programming, Examples on Programming, Interrupt Structure, Interrupt service Routine, Interrupt Vector Table, Hardware and Software Interrupts, INTR, NMI, Interrupt Response, Execution of an ISR, Priority of Interrupts.

Part B: Examples on Assembly Language Programming

Unit 3: (8+1 Hrs)
Interfacing with 8086 – I


8255 (Programmable peripheral interface 8255)-block diagram, control word, interfacing ADC (Successive Approximation Method), DAC (R–2R ladder Network.)

Part B: Interfacing of stepper motor, seven segment display, (8255)

Unit 4: (8+1 Hrs)
Interfacing with 8086 – II

Part A: 8253/8254 –(Programmable Interval timer/counter) block diagram, control word & interfacing, Mode0, Mode1, Mode3 of timer,

8251(USART): Features, Block Diagram, Control & status registers, Operating modes, Interfacing & Programming.
Part B: Programming of 8251, Programming of Timer Mode 1, Mode 2, Mode 3, Mode 4, Mode 5

Unit 5: (8+1 Hrs)
DMA Controller and NDP Co processor

Part A: Concept of DMA, 8237 DMA Controller: Features, Block Diagram & programming detail.
8087(NDP) - Features, Block Diagram, Control & status registers, typical Instruction set & programming detail.
Part B: Programming of 8237 and 8087(NDP).

Text Books

Reference Books

Additional Reading

Course Outcomes:
Upon completion of the course, graduates will be able to -

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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Describe the Structure and Internal Architecture of Pentium Processor and Microcontroller (PO1).</td>
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<td>2</td>
<td>Develop simple Programs (PO2).</td>
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<td>3</td>
<td>Address a Component Requirement to solve a Computing Solution (PO4).</td>
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<td>4</td>
<td>Design Interconnects of Microprocessor Peripherals (PO6).</td>
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<td>5</td>
<td>Validate design outputs using standards test equipments (PO8).</td>
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CS20114:: MICROPROCESSOR AND INTERFACING

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites:

List of Contents

A TERM-WORK containing the record of the following:

Assignments :

1. Understanding of different Memory Models

2. List various assembler directives,

3. Understand concepts of editor, assembler, linker, loader.

4. 8086 assembly language programming, to understand the basic concepts of various functions(01,02,08,09,0A) of INT 21h

5. List various debugging commands.

6. Interface 8086 microprocessor with 4KB RAM in minimum mode. Apply memory banking. Draw memory address map and explain address decoding logic.

7. Interface 8086 microprocessor with 16KB ROM in maximum mode. Draw memory address map and explain address decoding logic.

8. Design specified time delay (delay time calculation).

9. Near, Far procedures (string example).

10. Use of string instructions
11. Study of Mother Board

Note: Students should perform vi & vii assignments on drawing sheet

Text Books

Reference Books
CS21104:: MATHEMATICAL TRANSFORMS AND APPLICATIONS

Credits: 01
Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites:: Syllabus covered unit-wise in theory lectures.

List of Contents

In this module students will work on problems to practice and apply methods introduced in the theory lectures. Discussions of problems in small groups is always encouraged and facilitated. Students are asked to submit weekly home work assignments and provide them immediate feedback and support materials.

Tutorial No. 1: Summary on higher order linear differential equations, solution of homogeneous and non homogeneous equations, complementary solution.

Tutorial No. 2: Summary on particular solution by method of variation by parameters Method of undetermined coefficients and problems solving.

Tutorial No. 3: Summary on Euler – Cauchy and Legendre Equation, simultaneous equations and problems solving.

Tutorial No. 4: Summary on Functions of complex variables, Differentiation of functions of complex variables, Analytic functions, Harmonic functions, Harmonic conjugate.

Tutorial No. 5: Summary on Integration of functions of complex variables, integration along a path, Cauchy’s theorem, Cauchy’s integral formula, Cauchy’s residue theorem and problems solving.

Tutorial No. 6: Power Series, Taylor Series, Laurent Series

Tutorial No. 7: Summary on Laplace transform, Laplace transform of standard functions, Properties of Laplace and problems solving.

Tutorial No. 8: Summary on Properties of Laplace transform, Laplace transform of Unit step function, Dirac Delta function, Periodic functions and problems solving.

Tutorial No. 9: Summary on Inverse Laplace transform, properties of inverse Laplace transform, solution of differential equations by Laplace transform method and problems solving.
Tutorial No. 10: Summary on Fourier series, Complex form of Fourier series, Fourier integral representation and problems solving,

Tutorial No. 11: Summary on Fourier transform, Sine transform, Cosine transform and corresponding inverse and problems solving.

Tutorial No. 12: Summary on Discrete Fourier Transform, properties and problems solving.

Tutorial No. 13: Summary on Summary on Z transform, properties of Z transform, inverse Z transform, methods of solution and problems solving,


Text Books
CS20314:: MICROPROCESSOR AND INTERFACING

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practical

Group A: - (Any 6)

1. Study of 8086 Architecture and Execution of sample programs.

2. Write 8086 Assembly language program to access marks of 5 subjects stored in array and find overall percentage and display grade according to it.

3. Write 8086 ALP to perform block transfer operation. (Don’t use string operations) Data bytes in a block stored in one array transfer to another array. Use debugger to show execution of program.

4. Write 8086 ALP to find and count negative number from the array of signed number stored in memory.

5. Write 8086 Assembly language program (ALP) to arrange the numbers stored in the array in ascending as well as descending order. Assume that the first location in the array hold the number of elements in the array and successive memory location will have actual array elements. Write a separate subroutine to arrange the numbers in ascending and descending order. Accept a key from the user.
   a. If user enters 0, Arrange in ascending
   b. If user enters 1, Arrange in descending

6. Write 8086 Alp to convert 2_digit HEX number into equivalent BCD number.

7. Write 8086 ALP to convert 2_digit BCD number into equivalent HEX number.
Group B: - (Any 6)

1. Write 8086 Assembly language program (ALP) for following operations on the string entered by the user.
   a. Concatenation of two strings
   b. Find number of words, characters

2. Write 8086 ALP to convert an analog signal in the range of 0V to 5V to its corresponding digital signal using successive approximation ADC.

3. Write 8086 ALP to interface DAC & generate following waveforms on oscilloscope. Comment on types of DAC’s and write detailed specifications of the DAC used
   i) Square wave -- Variable Duty Cycle & frequency.
   ii) Stair case wave
   iii) Triangular wave

4. Write 8086 ALP to rotate a stepper motor for
   a. one clockwise rotation
   b. one anti clockwise rotation

   Write routines to accelerate and de-accelerate the motor
   Modify your program to rotate stepper motor for given angle and given direction.

5. Write 8086 ALP to program 8253 in Mode 0 . Generate a square wave with a pulse of 10 mS.

6. Write 8086 ALP to initialize 8279 & to display characters in right entry mode. Provide also the facility to display “SECOMP”/
   a. Character in left entry mode
   b. Rolling Display
   c. Flashing Display

7. Perform an experiment to establish communication between two USART’s. Initialize USART-A in asynchronous transmitter mode and interface USART-B by initializing it in asynchronous receiver mode.

Note: - Students should perform any 6 assignments from group A and any 6 assignments from group B.

Text Books

Reference Books
CS20305::PRINCIPLES OF PROGRAMMING LANGUAGES

Credits: 01  
Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: C

List of Practical

1. Write a C++ program to implement the concept of objects, classes, constructors, destructors.

2. Write a C++ program to implement the concept of Inheritance and polymorphism.

3. Write a C++ program to use the concept of generic programming (generic functions and generic classes)

4. Write a JAVA program to implement the concept of class, constructor, instance variable & class variable.

5. Write a JAVA program to implement the concept of inheritance, interface & package.

6. Write a Java program to implement the concepts of static polymorphism (function overloading) and dynamic polymorphism (using function overriding)

7. Write a JAVA program to use multithreading

8. Write a JAVA program for file handling.

9. Write a Java program with Graphical User Interface.

10. Write programs to implement list operations in Scheme programming language.

11. Write program in Scala to implement basic programming constructs

12. Mini project.

Text Books

Reference Books

Additional Reading
CS20310::COMPUTER GRAPHICS

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: C

List of Practical

1. Write a Program to implement DDA and Bresenham Line drawing algorithm.
2. Write a Program to implement Bresenham’s Circle drawing algorithm.
3. Write a Program to implement Polygon fill algorithm.
4. Write a Program to implement Scaling, rotation and translation of a 2D object.
5. Write a program to achieve animation by using segmentation.
6. Write a Program to implement Cohen Sutherland line clipping algorithm.
7. Write a Program to implement Polygon clipping algorithm.
8. Write a Program to implement Scaling, reflection about planes and axes of a 3D object.
9. Write a Program to draw a Koch curve, fractal line and surface.

Text Books


Reference Books

CS27402: MINIPROJECT

Credits: 02

Guidelines:
The Student has to select a project in group based on a topic of interest from any of the subjects offered in current Semester. Periodically the implementation will be evaluated by the guide.

Evaluation is done in two stages. In the first review the internal Guide evaluates the project against 40% of the implementation of work. At the end of semester each group will be evaluated by externally Guide from Industry based on their Presentation, completeness of Project implementation and report artifact.

Course Outcomes
Upon completion of the course, graduates will be able to -
1. Recognize essential & dominant area of technology for achievable artifacts over rapid period of time.
2. Acquire rapid application development cycle involving prototyping to learn adequate technological environments.
3. Concisely formulate specific problem in drafted specification format.
4. Devise data dictionaries and solution design with sufficient details.
5. Demonstrate the crafted solutions to user community with a lean learning curve.
6. Validate newer dimension of extendable and scalable nature of the problem solution crafting.
CS24302:: ASP.NET

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: C#.NET or VB.NET

List of Practical

1. Design simple web application using ASP.NET.
2. Design web application with different validations.
3. Design on line database application.
4. Design data report application.
5. Design web application for uploading files on web.
6. Design AJAX application.
7. Design localized web application.
8. Design WPF browser application.
9. Authentication and authorization in asp..
10. Deployment and publishing web sites.
11. Mini project.

Text Books

Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to -

The students should be able to
1. Analyze .NET framework, Common Language Runtime (CLR), garbage collection, and assemblies, forms, collections, constructs, delegates, events and exception handling.
2. Create data-driven web applications using the .NET Framework and ADO.NET.
3. Create web applications with rich UI and bug free experience using the ASP.NET standard Validation controls.
4. Evaluate problems and alternative web solutions using ASP.Net in a wide variety of business and organisational contexts.
6. Obtain hands-on on .Net Technologies to acquire responsible position in government and industry sectors.
CS24304:: Python

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: C programming.

List of Practical

1. Syntax basics, Arithmetic/String Operations, Input/Output
2. Control Flow constructs: If-else, Relational and Logical Operators
3. Iteration: While loop, For loop
4. Collections: Lists, Tuples
5. Collections: Sets, Dictionary
6. Functions and Modules: sys, math, time
7. File Handling: Data streams, Access modes, Read/Write/Seek
8. Exception handling: hierarchy, raise, assert
9. OOP: Classes, Objects
10. GUI programming: TkInter

Text Books


Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Develop functional, reliable and user friendly Python programs for given problem statement and constraints.

2. Correlate between the concepts of object oriented programming and the corresponding Python data structures while implementing programs using object oriented paradigm.

3. Judge a Python program in terms of correctness, space and time complexity and usability.

4. Adapt the existing solutions for familiar problems according to the needs/constraints of the similar problems.

5. Demonstrate competence through active participation in broader forums such communities supporting open source Python projects.

6. Utilize the problem solving and programming skills learned through the course for tackling relevant pressing issues in public and private sectors.
CS24307:: Ruby Programming

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: C programming.

List of Practical

Note: Specific exercises will be given in class.

1. Introduction to Ruby. Ruby resources. Implement a simple Ruby program to print Hello World. Understand standard types.

2. Demonstrate the use of control structures.

3. Implement a Ruby program to demonstrate arrays and hashing.

4. Implement a Ruby program for Classes and Objects. Demonstrate class constructors and methods, inheritance, access control.

5. Implement a Ruby program to demonstrate containers, blocks and iterators.

6. Implement a Ruby program to demonstrate regular expressions.

7. Implement a Ruby program to demonstrate exceptions and Input Output

8. Implement threads in Ruby.

9. Implement a website using Scaffold.

10. Implement a dynamic website using RAILS. Use MySQL as the backend.

11. Implement a game in Ruby. Also implement a simple strategy for the computer to play the game.

12. Mini Project: As assigned. This will involve implementing some application in MVC using RAILS.

Text Books

1. Dave Thomas, Chad Fowler and Andy Hunt Programming Ruby 1.9 & 2.0 (4th edition): The Pragmatic Programmers' Guide
Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Integrate functional specifications into an outline of a solution in RUBY.
2. Develop pragmatic programming practices in RUBY.
3. Identify good verification and validation techniques for testing code.
4. Propose RUBY patterns for new and unfamiliar problems.
5. Build a useful body of programs in RUBY for the wider developer community.
6. Utilize the programming skills for problem solving in public and private sectors.
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CS30101:: OPERATING SYSTEMS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Structures and Algorithms, Computer Organization.

Unit 1:  
Introduction to OS

Part A: Introduction to OS: What is OS, Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls.

Types of OS: Batch, Multiprogramming, Time sharing, Parallel, Distributed & Real-time OS.

Structures of OS: Monolithic, Layered, Ringed, Virtualization-Virtual Machines, Hypervisor, Exokernels, Client-server model, Microkernels.

Shell: Linux commands and shells, shell programming, AWK programming.

Introduction to Mobile OS: Architecture & Overview of Android OS.

Part B: Overview of Linux and Windows 2000 architecture

Unit 2:  
Process Management


Threads: Multithreading models, Thread implementations – user level and kernel level threads.

Symmetric Multiprocessing.

Concurrency: Issues with concurrency, Principles of Concurrency


Unit 3:  
Scheduling and Deadlock

(8+1 Hrs)

Scheduling Algorithms: FCFS, SJF, RR, Virtual Round Robin, Priority

Multiprocessor Scheduling: Granularity, Design Issues, Process Scheduling


Part B: Thread Scheduling, Real Time Scheduling.

Unit 4: Memory Management

(8+1 Hrs)


Virtual Memory: Concepts, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, VM with Segmentation.

OS policies for Virtual Memory: Fetch, Placement, Replacement, Resident Set management, Cleaning Policy, Load Control.


Part B: VM with combined paging and segmentation, Working Set Model.

Unit 5: I/O and File Management

(8+1 Hrs)


Disk Scheduling: FCFS, SCAN, C-SCAN, SSTF.


File System: Structure, Implementation, Memory mapped files, Special Purpose File Systems

Case study: Process Management, Concurrency, Scheduling, Memory Management, I/O Management, File Management(VFS) in LINUX

Part B: Organization of I/O functions, Disk Caches.
Text Books

Reference Books

Additional Reading

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Identify the mechanisms and strategies of an Operating System in order to solve real world problems. (scheduling, deadlock, paging, disk scheduling)
2. Develop solutions based on Operating system concepts in various contexts. (classical problems & all algorithms)
3. Automate the administrative tasks by means of modern tools in Operating System. (shell, AWK)
4. Examine the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve. (All function of OS)
5. Engage in a team towards development of a prototype Operating System. (lab)
6. Construct solutions to real world problems by applying the standard techniques used by Operating Systems for similar issues. (all numerics)
CS30116:: COMPUTER NETWORKS

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Communication.

Unit 1:
Introduction to Computer Networks and Logical Link Control

Part B: Point-to-Point Protocol (PPP), MPLS, Bridges, Gateways, Network Cables

Unit 2:
Medium Access Control

Part A: Channel allocation: Static and Dynamic allocation, Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, WDMA, Ethernet: Cabling, MAC Sub-layer protocol: DIX and IEEE 802.3 Frame Formats, Collision Detection, Binary Exponential Back-off Algorithm, Switched Ethernet, Fast Ethernet, Wireless 802.11a/b/g/n LANS, MACA, Broadband wireless: 802.16
Part B: Gigabit Ethernet, Layer-II Switch and Bluetooth

Unit 3:
Network Layer


Part B: Broadcast and Multicast routing, Routing for mobile hosts, IGMP, Mobile IP, VLAN

Unit 4:
Transport Layer

**Part A:** Services and service primitives, Elements of Transport protocol: Addressing, Connection establishment and release, flow control and buffering, Multiplexing, Crash recovery, UDP: Introduction, TCP: Introduction, Model, protocol, header, connection establishment and release, connection management, Transmission policy, congestion control, timer management, RPC, Transport layer in Mobile network.

**Part B:** Real Time Streaming Protocol RTSP, RTP, RTCP

**Unit 5:** (7+1 Hrs)

Application Layer

**Part A:** Domain Name System (DNS), Naming and Address Schemes, DNS servers, Email: MIME, SMTP and POP3. Remote login, File Transfer Protocol (FTP), SNMP, DHCP and BOOTP. CDN, Working of Bit Torrent, Cloud computing: Architectures and working principle.

**Part B:** World Wide Web, HTTP1.0, HTTP 1.1, Web Caching, Wireless Web.

**Text Books**


**Reference Books**


**Additional Reading**


**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. Interpret topological network architectures and essential components to design it.
2. Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency.
3. Uniformly demonstrate LAN behavior utilizing network architecture, protocols, and
network components.
4. Design client server based applications using sockets.
5. Demonstrate data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols.
CS30105:: THEORY OF COMPUTATION

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Structures.

Unit 1:  
Automata Theory

**Part A:** Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts to Automata Theory: Alphabets, Strings, Languages and Problems, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence and Minimization of Automata, Conversion of NFA with epsilon to DFA Equivalence of Moore and Mealy Machine. Applications and Limitation of FA.

**Part B:** FA with output: Moore and Mealy machine.

Unit 2:  
Regular Expressions (RE) and Languages

**Part A:** Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen’s Theorem, Regular expression to DFA, DFA to Regular expression, Non Regular Languages, Pumping Lemma for regular Languages, Myhill-Nerode theorem, Closure properties of Regular Languages, Applications of RE: Regular expressions in Unix, GREP utilities of Unix, Lexical analysis and finding patterns in text.

**Part B:** Decision properties of Regular Languages.

Unit 3:  
Context Free Grammars (CFG) and Push Down Automata(PDA)

**Part A:** Context Free Grammars: Definition, Examples, Derivation, Languages of Grammar, Derivation trees, Ambiguity in Grammar, Ambiguous and Unambiguous CFG, Inherent ambiguity, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs (Emptiness, Finiteness and Membership), Chomsky Hierarchy. Pumping lemma for CFLs

**Push Down Automata:** Description and definition, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, CFG to PDA construction (with proof). Equivalence of PDA and CFG (without proof).

**Part B:** Regular grammars, left linear and right linear regular grammars, regular grammar and finite automata.

Unit 4:  
(7+1 Hrs)
Introduction to Turing Machines

**Part A:** Turing Machines: Basic model, definition and representation, Instantaneous Description, Language acceptance by TM.
Robustness of Turing Machine model and equivalence with various variants: Two-way/One-way infinite tape TM, multi-tape TM, non-deterministic TM, TM as enumerator.
Recursive and Recursively Enumerable languages and their closure properties.

**Part B:** Comparison between Finite Automata, Push Down Automata, and Turing Machines.

**Unit 5:** (6+1 Hrs)

**Introduction to Undecidability**

**Part A:** Universal Turing Machines, Church-Turing Thesis and intuitive notion of Algorithm.
Introduction to countable and uncountable sets (countability of set of natural numbers, integers, rationals. Uncountability of set of real numbers, points in plane), Encoding for Turing machines and countability of set of all Turing machines. Existence of Turing unrecognizable languages.
Undecidability of Halting problem, Post Correspondence Problem. Example of a Turing unrecognizable language. Decision properties of R, RE languages and Rice’s theorem.

**Part B:** Hilbert’s tenth problem, undecidability of tiling problem

**Text Books**

**Reference Books**

**Additional Reading**

**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. To infer the applicability of various automata theoretic models for recognizing formal languages.
2. To discriminate the expressive powers of various automata theoretic and formal language theoretic computational models.
3. To illustrate significance of non determinism pertaining to expressive powers of various automata theoretic models.

4. To comprehend general purpose powers and computability issues related to state machines and grammars.

5. To explain the relevance of Church-Turing thesis, and the computational equivalence of Turing machine model with the general purpose computers.

6. To grasp the theoretical limit of computation (independent of software or hardware used) via the concept of undecidability.
CS31113:: Microprocessors and Microcontroller

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Microprocessors and Interfacings.

Unit 1:  
(8+1 Hrs)
Introduction to Pentium microprocessor

Part A: Historical evolution of 80286, 386, 486 processors. Pentium features and Architectures, Pentium Real mode, Pentium RISC features, Pentium super-scalar architecture - Pipelining, Instruction paring rules, Branch prediction, Instruction and Data caches. The Floating point Unit features & data types.

Part B: Pipelining stages.

Unit 2:  
(8+1 Hrs)
BUS cycles and Memory organization


Part B: Pentium Instruction Set.

Unit 3:  
(8+1 Hrs)
Microcontroller


Part B: Programmer’s model

Unit 4:  
(8+1 Hrs)
Microcontroller I/O interfacing


Part B: Design of Delay Routine using Hardware timers.

Unit 5:  
(8+1 Hrs)
Protected Mode Architecture of Pentium

Part A: Introduction, segmentation, support registers, related instructions, descriptors, memory management through segmentation, logical to linear address translations, protection by segmentation, privilege-level, protection, related instructions, inter-privilege level, transfer control, Paging-support registers, related data structures, linear to physical address translation, TLB, page level protection.

Part B: Programming of Protected mode

Text Books

Reference Books
1. ARM data Sheet.
2. Intel data Sheet.

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Describe the Structure and Internal Architecture of Pentium Processor and Microcontroller.
2. Develop simple Programs.
3. Utilize the Structures to effectively solve Computing Problems.
5. Design Effective Automation Solutions.
6. Lead Team to deliver Effective Designs.
CS31115:: ADVANCED DATA STRUCTURES

Credits: 02  
Teaching Scheme: - Theory 2 Hrs/Week

Prerequisites: Data Structures

Unit 1: (6+1 Hrs)
Hashing

Part B: Alternate hash functions (mid-square, folding, digit analysis), Double Hashing

Unit 2: (7+1 Hrs)
Priority Queue and Advance Heaps

Part B: Comparative study of different priority queue implementations using – binary heaps, leftist trees, binomial heaps, Fibonacci heaps with respect to the following operations – insert, delete, find-min, extract-min, decrease-key, meld

Unit 3: (6+1 Hrs)
Advanced Binary Search Trees

Part B: Insertion and Deletion in B Trees and B+ Trees

Unit 4: (6+1 Hrs)
Digital Search Structures

Part B: Space required and alternative node structures for a Trie.
Unit 5: (7+1 Hrs)

Data structures for Disjoint Sets and Linear Programming


Part A: Linear Programming duality

Text Books

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Demonstrate memory efficient solution in order to apply basic principle of programming perspective.
2. Analyze complexity issues for space and time bound scaled objective for programming solution.
3. Infer memory utilization with modularization useful for programming pragmatics.
4. Verify and narrate test condition in employing debugging technique to assist problem solving.
5. Elaborate on unrecognizable well organized problems based on realizable solutions
6. Contribute breadth of modularization in order to understand and implement realistic solution.
CS30101:: OPERATING SYSTEMS

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites:: Data Structures and Algorithms, Computer Organization.

List of Contents

A TERM-WORK containing the record of the following:

1. Execution of Advance Unix commands.

2. Write a shell program to sort an array of numbers using any sort method.

3. Execution of AWK related commands.

4. Implement the solution for Reader-Writer problem using Threads and Semaphores/Mutex.

5. Implement the solution for Producer-Consumer (Bounded Buffer) problem using Threads and Semaphore/ Mutex.

6. Implement the solution for Dining-Philosopher problem using Threads and Semaphore.

7. Implementation of resource allocation graph (RAG).

8. Implement the solution for Banker’s Algorithm for deadlock avoidance.

9. Draw the Gantt charts and compute the finish time, turnaround time and waiting time for the following algorithms:
   a. First come First serve
   b. Shortest Job First (Preemptive and Non-Preemptive)
   c. Priority (Preemptive and Non-Preemptive)
   d. Round Robin

10. Calculate the number of page faults for a reference string for the following page
replacement algorithms:
   a. Optimal
   b. FIFO
   c. LRU

11. Calculate the total distance traversed by the disk arm to satisfy the pending requests for the following disk scheduling algorithms:
   a. FCFS
   b. SSTF
   c. SCAN
   d. C-SCAN

Text Books

Reference Books

Additional Reading:
CS31215: ADVANCED DATA STRUCTURES

Credits: 01  Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: Data Structures

List of Contents

1. Example to indicate the limitations of static hashing and how it is addressed using dynamic hashing
2. Implement an application that uses bloom filter
3. Improve the performance of Dijkstra’s shortest path algorithm using Fibonacci heaps
4. Implement a binomial heap and compare its amortized complexity with binary heap
5. Implement a data store using Red Black trees as the underlying data structure
6. Implement an application that makes use of a prefix tree (trie) – address book, spell checker, auto completion etc.
7. Implement a solution for LCS problem (Longest Common Subsequence) using suffix trees
8. Improve the performance of Kruskal’s MST algorithm using disjoint set data structure
9. Write a program to solve a linear programming problem using simplex algorithm
10. Simulate a real-world application (search engine, file system, etc.) using one or more advanced data structures.

Text Books


Reference Books

CS30303:: OPERATING SYSTEMS

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Data Structures and Algorithms, Computer Organization

List of Practical
Part A:

1. Implementation of a multiprogramming operating system:

   a. Stage I:
      i. CPU/ Machine Simulation
      ii. Supervisor Call through interrupt

   b. Stage II:
      i. Paging
      ii. Error Handling
      iii. Interrupt Generation and Servicing
      iv. Process Data Structure

   c. Stage III:
      i. Multiprogramming
      ii. Virtual Memory
      iii. Process Scheduling and Synchronization
      iv. Inter-Process Communication
      v. I/O Handling, Spooling and Buffering

Text Books


Reference Books


Additional Reading

CS30316:: Computer Networks

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Data Communication

List of Practical

1. Set up a small network of 2 to 4 computers using Hub/Switch. It includes installation of LAN Cards, Preparation of Cables, Assigning IP addresses and sharing C drive.

2. File Transfer using PC To PC Communication.


4. Studying Linux and Windows network commands. [ ping, pathping, ipconfig/ifconfig, arp, netstat, nbtstat, nslookup, route, traceroute/tracert, nmap, etc]

5. Program for calculating CRC using Modulo-2 and Polynomial methods.

6. Simulate the sliding window protocols Go Back N and Selective Repeat.

7. File Transfer between two computers using TCP sockets.

8. Multiuser chat application using UDP sockets.

9. To create TCP/IP packet using standard TCP/IP include files and send it to other machine.

10. Program to find active and passive ports on nearby host using sockets.

12. Installing and configuring DHCP server for Linux/Windows.

Text Books

Reference Books

Additional Reading
CS31313:: Microprocessors & Microcontrollers

Credits: 01  Teaching Scheme: -Laboratory 2 Hrs/Week

Prerequisites: Microprocessor and Interfacings

List of Practical

Group A- Pentium
1. Write an ALP to simulate TYPE command using PSP.
2. Write an ALP to simulate COPY command using PSP.
3. Write an ALP to do the Following
   a) Capture MSW
   b) Display and Analyse Contents of GDTR IDTR LDTR
4. Write an ALP / in line code for displaying boot record of hard disk.
5. Write a Program to Demonstrate Code Cache Design
6. Write ALP for DPMI.
7. Write ALP for Mouse interface.
8. Study of Pentium motherboard.
9. Write ALP to implement multitasking using Pentium programming.

Group B- ARM-7
1. Write a program to interface Switch and LED.
2. Write a program to interface Timer.
3. Write a program to interface LCD.
4. Write a program to interface serial port.
5. Write a program to interface ADC.
6. Write a program to interface Stepper motor.

Text Books

Reference Books
1. Intel data sheet.
2. DOS data manual.
CS37401::MINI PROJECT

Credits: 02

Guidelines:
The Student has to select a project in group based on a topic of interest from any of the subjects offered in current Semester. Periodically the implementation will be evaluated by the guide.

Evaluation is done in two stages. In the first review the internal Guide evaluates the project against 40% of the implementation of work. At the end of semester each group will be evaluated by externally Guide from Industry based on their Presentation, completeness of Project implementation and report artifact.

Course Outcomes
Upon completion of the course, graduates will be able to -
1. Recognize essential & dominant area of technology for achievable artifacts over rapid period of time.
2. Acquire rapid application development cycle involving prototyping to learn adequate technological environments.
3. Concisely formulate specific problem in drafted specification format.
4. Devise data dictionaries and solution design with sufficient details.
5. Demonstrate the crafted solutions to user community with a lean learning curve.
6. Validate newer dimension of extendable and scalable nature of the problem solution crafting.
CS37301::SEMINAR

Credits: 02

Teaching Scheme: - Lab 2 Hrs/Week

Guidelines:

Seminar is a course requirement wherein under the guidance of a faculty member a student is expected to do an in depth study in a specialized area by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. Students are expected to choose a topic in CSE based on current trends or industry practices. While doing a seminar, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. Evaluation will be based on relevance of topic, understanding of the problem, literature Survey, presentation, communication skills, answering queries and reporting or documenting procedure.

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Scope and visibly identify technological trade off in computer engineering leading to significant topics.
2. Conduct a thorough literature survey of identify technical topic.
3. Present technical topic in written form with technical report or document
4. Communicate effectively technical topic in verbal form with suitable demonstration
5. Access real world problem scenarios in computer engineering.
6. Demonstrate skills and competences with an awareness of technical standardization.
CS37302::PROJECT STAGE I

Credits: 02

Guidelines:

Aim
This course addresses the issues associated with the successful management of a project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and working with peers to create desired outcomes. The Project Work can lead to:
   a. Transform existing Ideas into conceptual models.
   b. Transform conceptual models into determinable models.
   c. Use determinable models to obtain system specifications.
   d. Select optimum specifications and create physical models.
   e. Apply the results from physical models to create real target systems.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student’s own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.
3. The project must be based on a Fresh Idea or Implementation of a Theoretical Problem – meaning that there is not a known Solution to the design problem Or Create a Better Solution.
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting of Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. The Project Work will be assessed jointly by a panel of examiners. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.
7. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate’s performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.

8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners.

Assessment Scheme

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Content</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Concept</td>
<td>20</td>
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<tr>
<td>2</td>
<td>System Requirement Specification</td>
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<td>3</td>
<td>System Analysis</td>
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<td>4</td>
<td>System Design Block Diagram</td>
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<tr>
<td>5</td>
<td>Presentation of the Project Work</td>
<td>10</td>
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</tbody>
</table>

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Identify Real World Problems
2. Apply Computing Solutions to Real World Problems
3. Construct a Solution Model to Real World Problem
4. Select Design Pattern to Best approach the Solution.
5. Lay Down rules to Minimise Adverse Impact of Design Implementation
6. Adapt to changing Technological and Human resource advances.

Note:
The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members. The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted. Following is the list of recommended domains for Project Work:

<table>
<thead>
<tr>
<th>Computer Networks</th>
<th>Image Processing</th>
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<tbody>
<tr>
<td>Operating Systems</td>
<td>Artificial intelligence</td>
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<tr>
<td>Network Security</td>
<td>Expert Systems</td>
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<tr>
<td>Digital Signal Processing</td>
<td>Object Oriented Systems</td>
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<td>Systems Programming</td>
<td>Modeling and Design</td>
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<td>Real Time Systems</td>
<td>System Testing</td>
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<td>Embedded systems</td>
<td>Storage Management</td>
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<td>Cluster Computing</td>
<td>Client-Server Computing</td>
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<td>Mobile &amp;Wireless Comm.</td>
<td>Cloud Computing</td>
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<td>Multimedia Systems</td>
<td>Protocol Engineering</td>
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MODULE VI
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<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
<th>Credits</th>
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<td>CS30102</td>
<td>Software Engineering</td>
<td>$S_1$</td>
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<td>CS30314</td>
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<td>CS30306</td>
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<td>CS37402</td>
<td>Mini Project (T.Y. Semester I) Irrespective of Module</td>
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<td>CS37301</td>
<td>Seminar (T.Y. Semester I) Irrespective of Module</td>
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<td>CS30402</td>
<td>Comprehensive Viva Voce</td>
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<tr>
<td>CS37302</td>
<td>Project Stage 1 (T.Y. Semester II) Irrespective of Module</td>
<td>4</td>
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<td>30</td>
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**TOTAL** 14  16  2  26
CS 30102: Software Engineering

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Structures

Unit 1: Software Engineering Paradigms (8 Hrs)

Unit 2: Requirement Engineering (8 Hrs)
Part B: Requirements Verification and Validation, Requirement Maturity, Technical Reviews

Unit 3: System Analysis and Design Foundations (8 Hrs)

Unit 4: System Architecture Determination (8 Hrs)

Part B: Architecture Analysis Techniques, Zachman Framework, Architecture Assessment

Unit 5: Project Management Principles


Part B: Classic Mistakes, Complex Systems, Critical Systems, Software Safety

Text Books:

Reference Books:

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Identify the process models required to construct software in order to quench stakeholder needs and requirements.
2. Interpret the problem scope associated with real world problems.
3. Compose software artifacts with conformation to stated requirements.
4. Evaluate the criteria required to balance overall problem solution pair.
5. Demonstrate synergistic and cohesive team work that justifies solution realizations.
6. Build realistic solution assembled by either technological availability or through creativity.
CS30106:: DATABASE MANAGEMENT SYSTEMS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data structures

Unit 1: Introduction and Data Models  
(9+2 Hrs)

Data Models: Entity Relationship (ER) Model, Extended ER Model, Relational Data Model, Object Oriented Data model, Semi-structured Data Model: DTD or XML Schema
Part B: Spreadsheet Model, Codd's Twelve Rules for Relational DBMS, Life Cycle of a Relational Database

Unit 2: Database Design Theory  
(7+2 Hrs)

Part A: Normalization: Need, Functional Dependency, Inference Rules, FD Closure, Minimal Cover, Decomposition Properties, Normal Forms (upto BCNF), Multi-valued Dependency (4NF), Relational Synthesis Algorithm
Part B: Join and Inclusion Dependency, 5NF, DKNF, Trade-off

Unit 3: Query Languages  
(6+2 Hrs)

Part A: Formal Relational Query Languages: Relational Algebra, Tuple Relational Calculus;
SQL: DDL, DML, Select Queries, Join Queries, Subqueries;
PL/SQL: Procedure, Function, Trigger;
Query by Example;
Part B: Domain Relational Calculus, DCL-Security and Authorization, Date-Timestamp, String and Numerical Functions, Mapping of Relational Algebra to SQL

Unit 4: Storage and Querying  
(9+2 Hrs)

Part A: Storage: Storage and File structure, Files with Fixed / Variable Length Records, Hashed Files;
Indexing: Indexed Files, Single Level and Multi Level Indexes, B+ Trees;
Query Processing: Steps, Algorithms for Selection, Join Operation;
Query Optimization: Transformation of Relational Expressions, Choice of Evaluation Plans; Query Execution Cost;
Part B: SAN, Files with Sparse / Dense Index; Query Processing: Sort Operation, Impact of Indices on Query Performance;

Unit 5: Transaction Management and Emerging Trends  
(9+2 Hrs)

**Part A:** Transaction: ACID Properties, Concurrency Control Protocols: Lock-based, Multiple Granularity, Multiversion Scheme; Failure and Recovery; NoSQL: RDBMS vs NoSQL, BASE properties, NoSQL Categories; NewSQL; Emerging Trends: Distributed Databases, Distributed Data Storage, Distributed Query Processing; Parallel Databases, Architectures, Speedup and Scaleup, Decomposition, Data Replication; Time Series Databases, Spatial and Geographic Databases;

**Part B:** Design of Core DBMS Functions, Timestamp based Concurrency Control Protocol, ARIES Recovery Technique, Personal Databases

**Text Books**

**Reference Books**
3. "Getting Started with NoSQL: Your guide to the world and technology of NoSQL", by Gaurav Vaish

**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. Develop a database system using relational database query languages, PL/SQL and NoSQL.
2. Construct refined logical database model with consideration of data semantics and dependency.
3. Design data models to enforce data requirements and operational constraints of an organization.
4. Describe techniques used by a DBMS for data storage, access and query processing.
5. Describe various database system architectures and their functionalities.
6. Formulate alternative queries for given data requirement considering the query evaluation plan.
CS30108:: DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 03

Prerequisites: Data Structures

Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: (9+1 Hrs)
Overview of Time Complexity analysis, Divide and Conquer
Part A: Asymptotic notations (Big Oh, small oh, Big Omega, Theta notations). Best case, average case, and worst case time and space complexity of algorithms. Overview of searching, sorting algorithms (binary search, insertion sort, heap sort, bubble sort). Adversary lower bounds (for comparison based sorting, for finding second minima etc). Using Recurrence relations and Mathematical Induction to get asymptotic bounds on time complexity and to prove correctness of algorithms. Amortized complexity of algorithms.


Unit 2: (8+1 Hrs)
Dynamic Programming and Backtracking Strategies

Part A: Dynamic Programming: General strategy, simple dynamic programming based algorithms to compute Fibonacci numbers, binomial coefficients. Matrix Chain multiplication. Optimal binary search tree (OBST) construction, 0/1-Knapsack, Traveling Salesperson Problem, Shortest path in a Graph, Sequence Alignment problem, Scheduling problem.

Backtracking: General Strategy, n-Queen’s problem, Graph Coloring, Hamiltonian Cycles, 0/1 Knapsack, Subset sum problem.

Part B: String Editing Problem, Patience-sorting and O(n log n) algorithm for longest increasing sub-sequence problem. Solution for Peg-solitaire game.

Unit 3: (7+1 Hrs)
Greedy, Branch & Bound, Transform and Conquer techniques


Branch and Bound: General Strategy, 0/1 Knapsack, Traveling Salesperson Problem. Problem solving based on transform and conquer technique (Gaussian elimination, Horner’s rule and fast exponentiation etc). Heuristic based algorithms (Knight tour).

Part B: Postage stamp problem, n*n*n Queens problem, testing 2-colorability of graphs efficiently

Unit 4: (6+1 Hrs)
Introduction to Complexity Theory and NP-Completeness

**Part A:** Overview of deterministic and non deterministic Algorithms. Time Complexity classes P, NP, coNP, and their interrelation, EXP. Space complexity class PSPACE. Notion of polynomial time many one reductions reduction. Notion of NP-hardness and NP-completeness. Cook’s Theorem and implication to P versus NP question. NP-hardness of halting problem.


**Part B:** Decision Vs Search versions of problems in class NP, some problems in NP intersection coNP (linear programming, primality testing, perfect matchings in bipartite graphs).

**Unit 5:**

(10+1 Hrs)

Introduction to Randomized, approximation and online algorithms.

**Part A:** Randomized algorithms: Introduction to Las-Vegas and Monte-Carlo Algorithms. Abundance of witnesses/solutions and application of randomization, solving SAT for formulas with “many” satisfying assignments, Randomized Quick Sort, Karger’s algorithm for Min Cut problem, Coupon Collector problem.

**Approximation algorithms:** Introduction to NP-optimization problems, factor-2 approximation algorithm for Vertex Cover, hardness of approximation of Travelling Sales Person Problem(TSP), factor-2 approximation algorithm for metric TSP, approximation algorithm for set-cover.

**Part B:** Birthday paradox, probabilistic recurrences, generation of large primes and Prime Number Theorem. Approximation algorithm for bin packing problem.

**Text Books**


**Reference Books**


**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. To analyze asymptotic time and space complexity of an algorithm for worst, average and best cases using suitable mathematical tools.
2. To formulate computational problems in mathematically precise manner
3. To design efficient algorithms for computational problems using appropriate algorithmic paradigm
4. To prove NP-completeness of some decision problems
5. To grasp the significance of the notion of NP-completeness and its relation with intractability of the decision problems
6. To explain the role of randomization and approximation in computation
CS30114:: SYSTEMS PROGRAMMING

Credits: 02
Teaching Scheme: - Theory 2 Hrs/Week

Prerequisites:
- Data Structures
- Computer Organization
- Microprocessors

Unit 1:
Introduction to System Programming

Assemblers: Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assembler.
Macro Processors: Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, design of Macro Preprocessor. Booting Procedure for DOS & Windows,
Part B: RISC machines, Machine dependent and machine independent Assembler features.

Unit 2:
Compilers, Loaders and Linkers

Part A: Compilers: Introduction to Compiler phases, Introduction to cross compiler, Features of machine dependent and independent compilers, Overview of types of compilers, Interpreters.
Linkers: Relocation and linking concepts, Static and dynamic linker, subroutine linkages.
Loaders: Introduction to Loader, Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, relocating loaders, direct linking loaders.

Part B: Instruction description, Pseudo operations, Instruction Mapping, MSDOS Linker, Sun OS linker.

Unit 3:
Essential concepts of Systems programming for Linux as Open Source OS.

Part A: Introduction and essential concepts of LINUX system programming: System Programming, APIs and ABIs, standards, Program segments/sections; The ELF Format, Linking and loading, Linux dynamic libraries (shared objects), Multitasking and paging, Address translation, Memory Protection, Comparison with Windows.
Part B: Dynamic linking, API compatibility, Dynamically linked libraries, Overall architecture and limitations.

Unit 4: (6+1 Hrs)

Encoding, Decoding and Device drivers


Part B: Library Description for IA-32/Intel64.

Unit 5: (5+1 Hrs)

TSR Programming


Text Books

Reference Books

Course Outcomes
Upon completion of the course, the graduates will be able to -
1. Discriminate among different System software and their functionalities.
2. Design Device Drivers, TSR programs and DLL for real world applications.
3. Interpret the methods and techniques about instructions Encoding and Decoding for implementing system-level programs.
4. Deliver the knowledge and techniques in order to bridge the gap between the society and technology.
5. Adapt the skills and ethics to solve critical problems about System design and provide solutions to real world problems.
6. Develop approaches and methods for implementing different system-level software's.
CS31119 : Object Oriented Modeling and Design

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Structures

Unit 1: Introduction to Modeling (8 Hrs)
Part B: Methodology: Coad-Yordon, Responsibility-Driven Design, OPM, Catalysis, Aspect-Oriented Modeling

Unit 2: Model Driven Development (8 Hrs)
Part B: Domain-Specific Modeling: Fundamentals and Architecture, MDA Applications

Unit 3: Behavior Specification (8 Hrs)
Part A: Static Behavior: Use Cases, Use Case Diagram Components, Use Case Diagram, Actor Generalization, Include and Extend, Template for Use Case Narrative, Using Use Cases, The Domain Perspective, Data Dictionary: Finding the Objects, Responsibilities, Collaborators, and Attributes, CRC Cards, Class Models and Use Case Models, Judging the Domain Model, Capturing system behavior in use cases
Dynamic Behavior: Sequence diagrams, object lifelines and message types, Modeling collections multiobjects, Refining sequence diagrams, Collaboration diagrams, States, events and actions, Nested machines and concurrency, Modifying the object model to facilitate states, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swimlanes, concurrency and synchronization
Part B: Study of other Behavioral Diagrams: Communication Diagram, Interaction Overview Diagrams, Timing Diagrams

Unit 4: Design Specification (8 Hrs)
Part A: Design of Software Objects, Features and Methods, Cohesion and Coupling between Objects, Coupling and Visibility, Interfaces, Interfaces with Ball and Socket Notation, Templates, Analysis model vs. design model classes, Categorizing classes:
entity, boundary and control, Modeling associations and collections, Preserving referential integrity, Achieving reusability, Reuse through delegation, Identifying and using service packages, Improving reuse with design Packages and interfaces: Distinguishing between classes/interfaces, Exposing class and package interfaces, Subscribing to interfaces Component and deployment diagrams: Describing dependencies, Deploying components across threads, processes and processors Forward Engineering and Reverse Engineering Concepts

Part B: Application of UML in Real Time and Embedded System, Application of UML in Web Engineering, UML Profiles for other technology disciplines

Unit 5: Design Patterns (8 Hrs)


Part B: Antipatterns, Applications of Design Patterns, Archetype Patterns

Text Books:

Reference Books:

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Determine the unfamiliarity of the problem frames in order to envisage conceptual nomenclature.
2. Break down system functionalities into realizable customer-centric and developer-centric situations.
3. Narrate design specifications in terms of industries-specific practices such as methodology-driven engineering.
4. Propose multi-faceted defendable solutions with overt-behavior demonstrating team-skills.
5. Initiate new problem issues and compatible solution aspects with the help of design pattern.
6. Automatically devise solution terminologies reducing the potential of cost and performance impedance.
CS 30102: Software Engineering

Credits: 01  Teaching Scheme: - Tutorial 1 Hrs/Week

Prerequisites: Data Structures

List of Contents

A TERM-WORK containing the record of the following:

1. To study Software Process Models and identify their applicability to various categories of projects.

2. To understand Requirement Elicitation Techniques and recognize types of requirements while preparing System Requirement Specification.


4. To develop all level Data Flow diagrams for the target system indicating problem partitions and solution structure.

5. To apply design principles with relevant architecture style and structure the solution accordingly.

6. To prepare estimation for the System Development using Function Point technique.

Text Books:

Reference Books:
CS30108:: DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 01
Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: Data Structures and Files

List of Tutorials

1. Introduction to basic set theory, Mathematical Induction. Problem solving based on Induction and Recursion.
2. Formally proving correctness of algorithms using induction, loop invariants.
3. Studying asymptotic behavior of some non-standard functions like: H_n, log(n!), log*(n), Ackerman function etc. Problem solving based on asymptotic notations.
4. Problem solving based on simple binary-search like technique (perfect power testing, finding square roots efficiently etc.)
5. Introduction to Adversary lower bound technique and problem solving based on it (E.g. Adversary lower bound for finding two smallest elements in an array)
6. Problem solving based on Divide and Conquer technique
7. Divide and Conquer technique for problems in Computational Geometry (like convex hull computation, finding closest pair of points, discrete analog of Ham-Sandwich theorem etc)
8. Fast Fourier Transform and efficient uni-variate polynomial multiplication.
9. Problem solving based on Dynamic Programming strategy
10. Introduction to matroids and relation with Greedy strategy
11. Efficient implementation of Union-Find data structure and applications.
12. Problem solving based on Greedy strategy (formally proving optimality of solution for various greedy based problems)
13. Programming assignment on some problem based on Backtracking strategy (E.g. Sudoku solvers, Hi-Q solver, graph coloring etc.)
14. Relation between search and decision versions of problems in complexity class NP and their self reducibility property (particularly for SAT, Graph-Isomorphism, Hamiltonian Cycle etc)
15. Interesting problems in the complexity class NP intersection coNP, e.g. Linear Programming, Matchings in bipartite graphs, Primality testing.
16. Problem solving on Elementary Probability theory.
17. Problem solving on Elementary Probability theory.
18. Algorithms for enumeration and uniform generation of combinatorial objects (typically for permutations, subsets of fixed size, trees, derangements etc).
Problem solving based on design and analysis of approximation algorithms.

Text Books

Reference Books
CS30314:: SYSTEMS PROGRAMMING

Credits: 01
Teaching Scheme: - Lab 2 Hrs/Week

**Prerequisites:** Computer Networks.

**List of Assignments:**

**Objectives:**

1. Expanding the Simple Macros with Generating different Parameter Tables and MDT.
   - To understand various attacks in the network.
   - To learn various cryptographic techniques.
   - To understand authentication techniques.

2. Expanding the Nested Macros with Generating different Parameter Tables and MDT.

**Prerequisites:** Computer Networks.

3. Design and implementation of 1 pass and 2 Pass assemblers with generating different data structure for it.

**Objectives:**

4. Design and implementation of an Editor: Design of a Line or Screen Editor using C Language.
   - To understand various attacks in the network.
   - To learn various cryptographic techniques.
   - To understand authentication techniques.

5. Symbol table generation for input *.c file.


7. Simulation of linkers.

8. Simulation of loaders.

9. Understanding the design for DLL on Linux shared library.

10. Use of different debugger tools.

11. Printer controller in device drivers.

12. Write a TSR program in 8086 ALP to implement Real Time Clock (RTC). Read the Real Time from CMOS chip by suitable INT and FUNCTION and display the RTC at the bottom right corner on the screen. Access the video RAM directly in your routine.
13. Write a TSR program in 8086 ALP to implement Screen Saver. Screen Saver should get activated if the keyboard is idle for 7 seconds. Access the video RAM directly in your routine.

14. Write a TSR program in 8086 ALP to handle the “Divide by zero” interrupt. Test your program with a small code, which causes the divide by zero interrupt.

15. Write a TSR program in ‘C’ that would change the color of the screen every 10 seconds.

Note: It is expected that student must perform at least 2 assignments from assignment number 12 to 15.

**Text Books**


**Reference Books**

CS31319: Object Oriented Modeling and Design

Credits: 01  
Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Data Structures

List of Practical

1. To narrate Requirement Definition Document for the target system with following three areas:
   a. Problem Identification
   b. Problem Definition
   c. Problem Statement

2. To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system. Specify the behavior of the target system and map requirements to Use cases.
   The System Context Diagram depicts the overall System behavioral trace and Requirement Capture diagram depicts the hierarchical Use case Organization. The Use Case diagram should encompass
   a. Actors (External Users)
   b. Transactions (Use Cases)
   c. Event responses related to transactions with external agents.
   d. Detection of System boundaries indicating scope of system.

3. To depict the dynamic behavior of the target system using sequence diagram. The Sequence diagram should be based on the Scenarios generated by the inter-object Communication. The model should depict:
   a. Discrete, distinguishable entities (class).
   b. Events (Individual stimulus from one object to another).
   c. Conditional events and relationship representation.

4. To depict the state transition with the life history of objects of a given class model. The model should depict:
   a. Possible ways the object can respond to events from other objects.
   b. Determine of start, end, and transition states.

5. To depict the dynamic behavior using detailed Activity diagram.

6. To develop logical static structure of target system with Software Class diagram.
   To prepare Class Collaboration-Responsibility (CRC) cards for the Conceptual classes traced from System analysis phase. The design model should depict
a. Relationship between classes: inheritance, Assertion, Aggregation, Instantiation
b. Identification of objects and their purpose.
c. Roles / responsibilities entities that determine system behavior.

7. To represent physical module that provides occurrence of classes or other logical elements identified during analysis and design of system using Component diagram. The model should depict allocation of classes to modules. To narrate precise Program Design Language constructs separating computation from interface. To represent deployment view of the system through Architecture Diagram.

8. To enhance Software Class diagram to Architecture diagram with appropriate design patterns. To implement the system according to specification with confirmation to design patterns.

Text Books:

Reference Books:
CS30306:: DATABASE MANAGEMENT SYSTEMS

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practical

1. Choose a database system you propose to work on throughout the course. Perform requirements analysis in detail for design of the database. Design an entity-relationship (ER) data model for the selected database system.

2. Convert above ER model to relational model, semi_structured data model. List functional dependencies. Normalize these relations up to 3NF/BCNF.

3. Consider a different database system. List functional dependencies [Include complex business logic.] Apply bottom - up approach using Relational Synthesis Algorithm for design of relational model for the chosen system. Verify decomposition properties.

4. Create tables with appropriate constraints for the relational schema. Create views, indices, and sequence. Alter the schema by adding/removing columns and constraints. Write DML queries.

5. Execute ‘SELECT’ queries using order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, string etc.

6. Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / corelated subqueries using operators like =, in, any, all, exists etc. Write DML queries containing subqueries. Study a set of query processing strategies.

7. Write meaningful stored procedures in PL/SQL. Make use of cursors and different arguments. Write useful stored functions to perform complex computation. Write row level and statement level triggers in PL/SQL.

8. Implement a small database application for the above system using suitable front end and back end tool. Create a transaction by embedding SQL into an application program. Generate different useful reports.

9. Implementation of a small database using NoSQL and/or New SQL database system.

Text Books


Reference Books

3. "Getting Started with NoSQL: Your guide to the world and technology of NoSQL", by Gaurav Vaish
Vishwakarma Institute of Technology       Issue 05 : Rev No. 1 : Dt. 30/03/15

CS37402::MINI PROJECT

Credits: 02

Guidelines:
The Student has to select a project in group based on a topic of interest from any of the subjects offered in current Semester. Periodically the implementation will be evaluated by the guide.

Evaluation is done in two stages. In the first review the internal Guide evaluates the project against 40% of the implementation of work. At the end of semester each group will be evaluated by externally Guide from Industry based on their Presentation, completeness of Project implementation and report artifact.

Course Outcomes
Upon completion of the course, graduates will be able to -
1. Recognize essential & dominant area of technology for achievable artifacts over rapid period of time.
2. Acquire rapid application development cycle involving prototyping to learn adequate technological environments.
3. Concisely formulate specific problem in drafted specification format.
4. Devise data dictionaries and solution design with sufficient details.
5. Demonstrate the crafted solutions to user community with a lean learning curve.
6. Validate newer dimension of extendable and scalable nature of the problem solution crafting.
CS37301::SEMINAR

Credits: 02  
Teaching Scheme: - Lab 2 Hrs/Week

Guidelines:  
Seminar is a course requirement wherein under the guidance of a faculty member a student is expected to do an in depth study in a specialized area by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. Students are expected to choose a topic in CSE based on current trends or industry practices. While doing a seminar, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. Evaluation will be based on relevance of topic, understanding of the problem, literature Survey, presentation, communication skills, answering queries and documenting procedure.

Course Outcomes:  
Upon completion of the course, graduates will be able to -

1. Scope and visibly identify technological trade off in computer engineering leading to significant topics.
2. Conduct a thorough literature survey of identify technical topic.
3. Present technical topic in written form with technical report or document
4. Communicate effectively technical topic in verbal form with suitable demonstration
5. Access real world problem scenarios in computer engineering.
6. Demonstrate skills and competences with an awareness of technical standardization.
### Module VII

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CS40115: DISTRIBUTED COMPUTING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Operating Systems.

Unit 1: Introduction


Introduction to Hadoop/MapReduce.

Part B: Conceptual design of a Distributed File System based on concepts learned in Unit 1.: Reading: Hadoop/MapReduce.

Unit 2: Communication


Part B: Case studies of existing RPC implementation. Design a RPC/RMI mechanism based on the case studies and concepts learned in class.

Unit 3: Synchronization

Part A: Time and Global States: Clock Synchronization, Logical Clocks, Scalar time, Vector time, Global State, Event Ordering.

Co-ordination: Election Algorithm: Bully Algorithm, Ring Algorithm, Mutual Exclusion: Requirements, Performance metrics, Centralized Approach, Lamport’s algorithm, Distributed Approach (Ricart and Agrawala)

Distributed Deadlock Algorithms for Avoidance, Prevention, and Detection: Classification of distributed deadlock detection algorithms, Centralized Approach, Hierarchical Approach, WFG Based Fully Distributed, Deadlock Recovery.

Part B: Comparative analysis of time synchronization/mutual exclusion/election algorithms implementations in well-established distributed systems.
Unit 4: 
Fault Tolerance 


Part B: Identify the issues that can arise in your DFS prototype in case of various failures. Based on the concepts learned in Unit 1:V design a fault tolerance mechanism for the DFS. Develop test-case scenarios to assess the system's resilience. 

Unit 5: 
Distributed Transaction and Distributed Shared Memory 

Part A: Distributed Transaction: Transaction Model, Classification, Implementation, Concurrency Control: Serializability, 2 Phase Locking, Strict 2 PL, Distributed Commit: 2 Phase Commit, Recovery 

Part B: Distributed File Systems : Data Intensive Computing, Google FS, BigTable 

Text Books 

Reference Books 

Additional Reading 
Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Develop the solutions for Communication, Synchronization, Mutual exclusion and Deadlock handling in distributed computing.

2. Identify the basic principles, design requirements and challenges associated with implementing large-scale distributed system.

3. Design of distributed application using modern tools in Distributed System.

4. Construct an optimal and cost-effective solution without compromising the security and reliability of the system with respect to convenience, efficiency and the ability to evolve.

5. Build a basic prototype distributed system for different applications in a team.

6. Apply principles of distributed computing while building appropriate variations of existing solutions to meet the development contexts.
CS40114:: BUSINESS INTELLIGENCE AND ANALYTICS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Database Management Systems.

Unit 1:  
(8+1 Hrs)

Part A:

Data Warehousing & Multi-Dimensional Modeling: What is a data warehouse, need for a data warehouse, four characteristics of a data warehouse, components/architecture of a data warehouse, data marts, building a data warehouse. OLTP vs OLAP.

Multidimensional Modeling: ER Modeling vs Multi-Dimensional Modeling, Data cubes, OLAP operations, lattice of cuboids, multi-dimensional schemas (star, snowflake, galaxy), facts, dimensions, concept hierarchies, types of dimensions, measures

Data Integration: different types of digital data and their sources, ETL (extract-transform-load)

Enterprise Reporting: Metrics, Measurement, Measures, KPIs, Dashboards, Reports, Scorecards

Part B: Examples of business analyses – funnel analysis, distribution channel analysis and performance analysis; levels of decision making (strategic, tactical and operational BI); types of facts; types of measures; different OLAP architectures

Unit 2: Descriptive Analytics - I  
(8+1 Hrs)

Part A:
Data Preprocessing: mechanisms of data collection and challenges involved therein. Typical preprocessing operations: combining values into one, handling incomplete or incorrect data, handling missing values, recoding values, subsetting, sorting, transforming scale, determining percentiles, data manipulation, removing noise, removing inconsistencies, transformations, standardizing, normalizing - min-max normalization, z-score standardization, rules of standardizing data.
Data visualization: role of visualization in analytics, different techniques for visualizing data based on the nature of data and what kind of insights need to be drawn

Descriptive Statistics: role of statistics in analytics, types of data (scales of measurement - NOIR), data distributions, measures of variability (range, quartile, five number summary, variance, std dev, coeff of variation), analyzing distributions, Chebychev’s Inequality, measures of shape (skewness, kurtosis), measures of association (covariance, correlation), outliers

Part B: Data quality and its various aspects, measures of central tendency (arithmetic mean, geometric mean, harmonic mean, median, mode)

Unit 3: Descriptive Analytics - II (7+1 Hrs)

Part A:

Inferential Statistics: Role of probability in analytics. Need for sampling, generating samples, sampling and non-sampling error. Sampling Distribution of Mean, Central Limit Theorem, Standard Error.

Estimation: Point and Interval Estimates, Confidence Intervals, level of confidence, sample size.

Hypothesis Testing: basic concepts, Errors in hypothesis testing, Power of test, Level of significance, p-value, general procedure for hypothesis testing. Parametric tests – z test, t test, chi-square test. Hypothesis testing of means: two tailed and one-tailed tests. Chi-square test for independence and goodness of fit. Hypothesis testing for comparing two related samples. Limitations of hypothesis testing. Picking up the right test for a given scenario.

Part B: Common probability distributions and their characteristics, parametric vs non-parametric tests, ANOVA

Unit 4: Predictive Analytics (8+1 Hrs)

Part A:

Similarity Measures: Design of recommender systems - user based and item based collaborative filtering

Modelling: Data Modelling Basics, Logic driven modeling, data driven modeling
**Regression Analysis:** Correlation and regression, Simple Linear Regression Model, Least Squares Method. Making Data Models more flexible, making data models more selective, dealing with Categorical variables, Interpretation of regression coefficients, fine tuning data models (assessing the fit, model fitting), Coefficient of determination, Significance tests, Residual analysis, Prediction intervals. Model evaluation techniques. Assumptions of regression analysis.

**Introduction to Time Series Analysis and Forecasting:** Time series patterns, forecast accuracy, moving averages and exponential smoothing, casual models, using regression analysis for forecasting, determining best forecast model to use, ARIMA models

**Part B:** Basic *what-if* spreadsheet models, different types of regression and which is used when, modeling non-linear relationships, heteroscedasticity, multicollinearity

**Unit 5: Prescriptive Analytics & Emerging Trends in BI&A** (8+1 Hrs)

**Part A:**

**Optimization Analytics:** Overview of simulation and risk analysis, Linear Optimization Models (linear programming), Integer Linear Optimization models (integer programming), Non-linear optimization models (portfolio theory), Monte Carlo Simulation, Decision Analysis

**BigData Analytics:** What is Big Data, sources of BigData, MapReduce, Hadoop, statistical analysis of big data, visualizing bigdata

**Familiarity with the following areas:** multi variate analytics, text analytics, web analytics, social media analytics, in-memory analytics – row vs columnar databases, in-memory databases

**Part B:** NoSQL databases for unstructured data and its role in analytics, analytics in the cloud, embedded BI, mobile analytics, mobile BI, Data Stream Analytics, Customer Centricity, Patient Centricity, IoT, Self-Service BI, Fog networks

**Text Books**
1. “Business Analytics” by James R Evans, Pearson
Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Construct an end-to-end data warehousing solution for business intelligence involving various data sources, ETL, multi-dimensional modeling, OLAP, reporting and analytics
2. Evaluate various data processing algorithms in their applicability to different problems
3. Display the process of converting data into a user defined format required for particular analysis
4. Utilize statistical tools in deriving insights from data
5. Describe various techniques for descriptive, predictive and prescriptive analytics
6. Apply various techniques to solve real-world data analysis problems
CS42105:: MOBILE COMPUTING

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:
- Communication Engineering
- Computer Network

Unit 1: Cellular Network


Part B: Signal and signal propagation, IEEE 802.11standard, 802.11a,b,g, 802.15,

Unit 2: GSM Communication

Part A: System Architecture: GSM Radio subsystem, Interfaces, Network and switching subsystem, Operation subsystem, GSM channels, GSM protocol architecture, Location tracking and call setup, Security, Data services N/W signaling, GSM mobility management, Administration and maintenance.
Handoff- Initialization of handoff, Delaying handoff, Forcing handoff, Power different handoff. Mobile assisted handoff, Intersystem handoff.


Unit 3: GSM Bearer Services

Part A: SMS architecture protocol, Hierarchy, VOIP services for mobile networks.
WAP: model and architecture, Gateway, protocol stack.
Telecommunication system: GPRS, wireless in local loop, DECT, EDGE, UMTS, Paging systems, CDPD.

Part B: Wireless application environment, Bluetooth.

Unit 4: Mobile Network and Transport layer
Mobile Transport layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/recovery, Transmission/time-out freezing, Selective retransmission, Transaction-oriented TCP.
Part B: TCP over 2.5/3G wireless networks.

Unit 5: Mobile Databases

Part A: Database hoarding, Data caching, Data cache and web cache maintenance in mobile environments, Client-Server computing and adaptation, Query processing, Data recovery process, Issues relating to quality of service, Digital audio broadcasting: DAB System, DAB objects, Object transfer protocol, DVB: DVB system.
Part A: Mobile Billing

Text Books

Reference Books

Course Outcomes:
Upon completion of the course, the students will be able to:
1. Describe the functional specification of 2G and 3G Cellular Network Standards.
2. Compute performance parameters for designing the Cellular Network.
3. Propose Telecommunication system to be deployed to fulfill bandwidth capacity planning.
4. Justify the Mobile Network performance parameters and design decisions.
5. Predict the requirements of next generation mobile network.
6. Design Mobile Application to solve a real world problem.
CS42131: Enterprise Systems

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Software Engineering, Database Management System

Unit 1:: Business Process Management ( 8 Hrs )
Process Orchestrations: Control Flow Patterns, Workflow Nets, Business Process Modeling Notation
Process Choreographies: Motivation and Terminology, Development Phases, Process Choreography Design and Implementation, Service Interaction Patterns
Properties of Business Processes: Data Dependencies, Structural Soundness, Soundness, Relaxed Soundness, Weak Soundness, Lazy Soundness, Soundness Criteria Overview
Part B: Petri Nets, Event-driven Process Chains, Yet Another Workflow Language, Graph-Based Workflow Language

Unit 2:: SOA Fundamentals ( 8 Hrs )
Service Contracts (Standardization and Design): Contracts principles, Types of Service Contract Standardization, Contracts and Service Design, Versioning, Technology/Development Tool Dependencies
Part B: XML; HTTP; SOAP

Unit 3:: SOA Design Principles ( 8 Hrs )
Part A: Service Abstraction (Information Hiding and Meta Abstraction Types): Abstraction principles, Types of Meta Abstraction, Measuring Service Abstraction, Service Abstraction and Service Design, Risks Associated with Service Abstraction
Service Reusability (Commercial and Agnostic Design): Reuse Principle, Service Reuse in SOA, Service Reusability and Service Design
Service Autonomy (Processing Boundaries and Control): Autonomy Principle, Types of Service Autonomy, Measuring Service Autonomy, Service Contract Autonomy (services with normalized contracts) Autonomy and Service Design
Service Statelessness (State Management Deferral and Stateless Design): State Management, Measuring Service Statelessness, Statelessness and Service Design
SOA Delivery Strategies, Service-Oriented Analysis: Introduction, Service Modeling, Service-Oriented Design: Introduction, SOA Composition Guidelines), Service Design
Part B: Importance of WSDL, SOAP, The use of registries via UDDI

Unit 4:: SOA Technology and Implementation ( 8 Hrs )
Part A: Service Discoverability (Interpretability and Communication): Discoverability, Types of Discovery and Discoverability, Measuring Service Discoverability, Discoverability and Service
Service Composability (Composition Member Design and Complex Compositions): Composition, Composition Concepts and Terminology, Complex Service Composition, Measuring Service Composability and Composition Effectiveness Potential, Composition and Service Design, Service-Orientation and Object-Orientation, Mapping Service-Orientation Principles to Strategic Goals
Part B: SOA Platforms, SOA support in .NET and J2EE platforms

Unit 5:: Enterprise Architecture ( 8 Hrs )

Text Books:

Reference Books :

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. To model business requirements and business processes using BPMN 2.0 standard
2. To discover the set of services with composite services creation and designing services to facilitate integration and understand interrelationships among SOA, Web Services, OOD and an IT infrastructure
3. To focus Enterprise SOA and facilitate use of Enterprise Service Bus in an Enterprise SOA
4. To explore the concepts and technology for service orchestration and discuss the guidelines to integrate a Business Process Management Solution in an Enterprise SOA.
5. To practice the concepts, specifications, and technologies for service composition and explore the role of an enterprise service bus in an Enterprise SOA.
6. To understand case studies, lessons learned, and best practices for planning and implementing SOA projects.
CS42127:: CLOUD COMPUTING

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Computer Networks, Operating Systems, Web Technologies

Unit 1: Introduction  
(6+1 Hrs)


Part B: Study of top 5 cloud providers and top 5 applications on cloud

Unit 2: Architecture and IaaS  
(8+1 Hrs)

Part A: Cloud Computing Architecture: Cloud computing stack - Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Deployment Models, Public cloud, Private cloud, Hybrid cloud, Community cloud

Part B: Study top 5 open source tools for building private cloud along with pros/cons

Unit 3: PaaS and SaaS  
(7+1 Hrs)


Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

Part B: Innovative applications of cloud computing

Unit 4: Cloud Management and Security  
(10+1 Hrs)

Part A: Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data - Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud; Large Scale Data Processing


Part B: Study the cloud deployment of a big enterprise

Unit 5: Cloud Solutions  
(9+1 Hrs)

Part A: Case study on Open Source and Commercial Clouds – Amazon EC2, Google Compute Engine, Microsoft Azure, Cloudfoundry, OpenStack

Part B: How the CDNs (Content Delivery Networks) make use of the cloud?

Text Books
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
Reference Books
2. *Cloud Security & Privacy* by Tim Malhar, S. Kumaraswamy, S. Latif (SPD, O’REILLY)
4. *Cloud Computing Bible* by Barrie Sosinsky, Wiley India.
5. *Cloud Computing*, Michael Miller, Que Publishing

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.
4. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
5. Choose the appropriate technologies, algorithms, and approaches for the related issues.
6. Display new ideas and innovations in cloud computing.
CS42103: PARALLEL COMPUTING ON GPU

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: (8+1 Hrs)
Parallel programming basics

Part A: Parallel programming definition, motivation, Types and levels of parallelism, Different grains of parallelism, data dependence graph, data parallelism, functional parallelism, Flynn's classification of multi-processors, Motivation for heterogeneous programming, Definition of thread and process, programming parallel computers- extend a compiler, extend a sequential programming language, add a parallel programming layer, create a parallel language.
Part B: multiprocessor and multicomputer systems, interconnection networks

Unit 2: (8+1 Hrs)
Introduction to GPU, architecture and parallel algorithms

Part A: Introduction to GPU computing, motivation, Modern GPU architecture case study: NVIDIA Fermi Tesla C2050/Kepler K20, GPU memories- global, shared, texture memory and their properties and uses, roles of CPU and GPU in parallel computing, GPU computing domain areas and success. Parallel algorithm design. Speedup and scalability.
Part B: parallel algorithm design for data clustering, theory of locality of reference

Unit 3: (8+1 Hrs)
Compute Unified Device Architecture (CUDA)

Part A: CUDA Architecture, CUDA programming model, execution model, thread organization: Concept of grid, block and thread, thread index generation, warp; memory model: Introduction to global, shared, local memories, usage of cache, texture cache, constant memory, memory banks and bank conflicts, memory coalescing,. CUDA structure and API details. CUDA example programs (Vector dot product, Vector-Matrix multiplication and etc).

Part B: atomic operations in CUDA

Unit 4: (8+1 Hrs)
Problem solving using GPUs
Part A: Single vs double precision, solving problems that involves Vectors, Matrices, Binomial coefficients, Bernstein coefficients and etc. Instructor will choose the problems from several domains.

Part B: Study problems given by instructor

Unit 5: (8+1 Hrs)

Parallel reduction and Tools

Part A: Reduction operation using prefix sum example. Performance issues in algorithms- deciding parallelization of a part of algorithm and selecting the highest parallelism, Need of profilers, Introduction to CUDA Tools: MemCheck and Visual Profiler.

Part B: Memory leaks and associated problems

Text Books
2. CUDA by Example: An Introduction to General-Purpose GPU Programming by Jason Sanders and Edward Kandrot
3. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn, Tata McGraw-Hill Edition

References:
2. www.tutorials on introduction to parallel computing
3. Other references suggested by instructor

Course Outcomes
Upon completion of the course, graduates will be able to -

1. Analyze the real problem for exploiting maximum parallelism on GPU architecture
2. Solve the complex problems using GPUs
3. Compare serial and parallel executions.
4. Code and optimize the parallel programs on GPU using CUDA.
5. Apply parallel computing methods to research oriented problems.
6. Evaluate success of CUDA projects
CS42132: NETWORK SECURITY

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Computer Networks.

Unit 1: Introduction (8+2 Hrs)


Unit 2: Private key cryptography (8+2 Hrs)

Part A: Mathematical background for cryptography: modulo arithmetic, GCD (Euclid’s algorithm), algebraic structures (Groups, Rings, Fields, Polynomial Field). Role of random numbers in security, Importance of prime numbers Data Encryption Standard: Block cipher, Stream cipher, Feistel structure, round function, block cipher modes of operation, S-DES, Attacks on DES, S-AES, AES.

Part B: Chinese remainder theorem, Elementary Ciphers (Substitution, Transposition and their Properties), Frequency analysis

Unit 3: Public key cryptography (8+2 Hrs)


Unit 4: Authentication and access control (8+2 Hrs)
Authentication Applications: Kerberos, X.509 authentication service, public key infrastructure.
Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.

Part B: Authentication and authorization tools, Biometrics.

Unit 5: (8+2 Hrs)
Security application and design

Transport layer security: SSL and TLS.
Application layer security: Security services, S/MIME, PGP, PEM, Https, Honey pots.
Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs


Text Books

Reference Books

Additional Reading

Course Outcomes
Upon completion of the course, the students will be able to:

1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
2. Establish type of attack on a given system.
3. Simulate different types of attacks using tools.
4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.

6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.
CS42101:: ADVANCED COMPUTER GRAPHICS

Credits: 03  Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Computer Graphics

Unit 1: OpenGL  
(8+1 Hrs)

Part B: OpenGL over Linux, pBuffer rendering, Shadowing Techniques.

Unit 2: Graphics Hardware  
(8+1 Hrs)

Part A: Graphics card, Components of graphics card, General-Purpose computation, GPU, GPGPU, CUDA architecture, CUDA Programming: Type qualifiers, Execution configuration, vector types, functions, APIs.
Part B: How graphics card works? GeForce 6800 series GPU architecture.

Unit 3: Advanced Rendering Techniques  
(8+1 Hrs)

Part B: Splines, Tessellation, 3D viewing.

Unit 4: Photorealistic and Volume Rendering  
(8+1 Hrs)

Part B: Monte Carlo mathematical formulation, Marching cubes algorithm.

Unit 5: Texture Synthesis and Image Processing  
(8+1 Hrs)
Part A: Texture synthesis, Image processing: Digital image representation, Image data structures, Sampling and Quantization, Image enhancement in spatial domain.

Part B: Image compression, Image synthesis.

Text Books

Reference Books

Additional Reading

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Design algorithms/programs for 2D/3D graphics using OpenGL.
2. Discriminate data structures and algorithms of 3D modeling, visibility and rendering.
3. Describe graphics hardware for its functions and programming.
4. Distinguish algorithms of global illumination and 3D volume rendering.
5. Conform the use of image and texture processing for graphics.
6. Construct creative 2D/ 3D graphics models.
CS42125:: Randomized and Approximation Algorithms

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: Basic probability theory
(8+1 Hrs)
Part A:
Introduction to randomization in computation and some simple randomized algorithms.

Basic discrete probability theory: basic counting, definition of probability, examples, independence of events, conditional probability, union bound, inclusion exclusion, Bayes’ rule, discrete random variables, expectation, variance, linearity of expectation, sum of independent random variables, standard distributions (Bernoulli, Binomial, Geometric), coupon collector problem, birthday paradox, probabilistic recurrences.

Uniform generation of combinatorial structures. Indicator random variables and their role in algorithm analysis.

Part B:
Review Las Vegas and Monte-Carlo algorithms (with examples: randomized quick sort, Karger’s min-cut algorithm.)

Unit 2: Tail inequalities, randomized complexity classes
(8+1 Hrs)
Part A:
Tail Inequalities and applications
Moments and deviation, occupancy problem, Markov and Chebyshev inequalities and some applications, randomized selection, weak law of large numbers, stable marriage problem and principle of deferred decision, coupon collector problem and sharp threshold, Chernoff’s bound and some applications, set balancing.

Complexity classes
Basic complexity classes P, NP, RP, Co-RP, ZPP, BPP and their interrelations, probability amplification in RP and BPP, randomness and nonuniformity, Adleman’s theorem.

Part B:
Yao’s min-max principle and lower bound for randomized computations.

Unit 3: Algebraic techniques
(8+1 Hrs)
Part A:
Polynomial identity testing, Schwartz-Zippel lemma and applications (with examples verifying matrix multiplication, testing equality of strings, perfect matching problem for bipartite graphs), Mulmuley-Vazirani-Vazirani isolation lemma and application to matching problem. Number theoretic algorithms (finding quadratic non-residues, primality testing), introduction to probabilistic methods.

Part B:
Application of randomized algorithms in geometric problems (Convex hulls, half space intersection, Delaunay triangulations, diameter of point set).

Unit 4: Markov Chains and Random Walks
(8+1 Hrs)
Part A:
Markov chains: definition, representations, randomized algorithm for 2-SAT and 3-SAT, classifying states of Markov chains, Gambler’s ruin, stationary distributions. Random walks on undirected graphs, cover time, hitting time, commute time, graph connectivity, electrical networks, introduction to expander graphs.

Part B:
Expanders and rapidly mixing random walks.

**Unit 5: Approximation Algorithms** (8+1 Hrs)

Part A:
Introduction to approximation algorithms, NP-hard optimization problems, lower bounding OPT, example of set-cover (O(log n) factor approx-algorithm based on greedy strategy, layering), Shortest super-string problem, Knapsack and FPTAS algorithms. Linear programming based algorithms, LP relaxation, LP duality. LP rounding strategy and primal-dual schema, set-cover and some other examples using LP based techniques, maximum satisfiability.

Part B:
Review Vertex cover problem, Traveling Salesman Problem (TSP), general TSP hard to approximate, metric TSP.

**Advanced Topics:**
(depending on the availability of time some of the following topics may be included)
Role of expander graphs in derandomization, hardness of approximation, statement of PCP theorem, approximation algorithms for classical problems on integer lattices.

**Text books:**
2. *Probability and computing* by Michael Mitzenmacher, Eli Upfal
3. *Approximation Algorithms* by Vijay V. Vazirani (Springer)

**References :**

*For some of the topics some online lecture-notes or original papers are used as reference.*

**Course Outcomes:**

Upon completion of the course, graduates will be able to -
1. To solve problems based on the basic discrete probability and combinatorics
2. To design Las-Vegas, Monte-Carlo randomized algorithms for various computational problems
3. To analyze time complexity and success probability of randomized algorithms using random variables.
4. To illustrate application of tail inequalities in tight estimation of the success probability and the time complexity of randomized algorithms
5. To explain role of advanced algebraic techniques such as Schwartz-Zippel Lemma, Isolation Lemma, Markov chains and random walks on graphs in randomized algorithms design
6. To design approximation algorithms for NP-complete problems using suitable paradigm
CS42113:: DIGITAL SIGNAL PROCESSING

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  
Introduction to signals and systems


Part B: Properties of LTI systems, parallel and cascade connection, Correlation of DTS.

Unit 2:  
Z and Fourier transforms


Part B: Symmetry properties of F. T, F. T. theorems: Linearity, time shifting, frequency shifting, time reversal, differentiation.

Unit 3:  
Frequency analysis of Signals and Systems


Sampling the F.T., Fourier representation of finite-duration sequences, The Discrete Fourier Transform, Properties of DFT: circular shift, duality, symmetry, Circular Convolution, Linear Convolution using DFT, Effective computation of DFT and FFT, DIT FFT, Overlap and save algorithm, Inverse DFT using FFT(DIF)
Part B: Properties of DFT: Linearity, DIF FFT, Goertzel Algorithm, Inverse DFT using FFT (DIT)

Unit 4: Design of Digital Filters  
(9+1 Hrs)

Part A: Concept of filtering, Ideal filters and approximations, specifications, IIR filter design from continuous time filters: Characteristics of Butterworth, Chebyshev approximations, impulse invariant and bilinear transformation techniques, Design examples, FIR filter design using windows: properties of commonly used windows, systems with linear phase, Generalized Linear phase systems, Four Types of GLPS (Type I), Design Examples, Design using Kaiser window, Comparison of IIR and FIR Filters.

Part B: Four Types of GLPS (Type II, III, IV), Examples on Filter Design (IIR & FIR)

Unit 5: Realization of Filters  
(7+1 Hrs)


Part B: Instruction set of ADSP 21XX series processor and some examples.

Text Books

Reference Books

Course Outcomes:
Upon completion of the course, graduates will be able to -
1. Convert analog signal into a digital signal without irreversible data loss using mathematical techniques.
2. Design faster algorithms for signal domain conversion which ensures expected operation on all architectures.
3. Design filters meeting the given specifications with the help of Matlab.
4. Design a stable system which requires minimum components to implement.

5. Analyse a signal in different mathematic domains to understand the signal characteristics.

6. Differentiate between various realizations techniques.
CS42119:: INFORMATION RETRIEVAL

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Data Structures, Database Management Systems

Unit 1: Information Retrieval Introduction and Models  
(9 Hrs)
Part A: Introduction, Definition, Objectives, Search and Browse Capabilities; A Formal Document Representation, Characterization of IR Models, Boolean Retrieval, Extended Boolean Models, Vector Space Model, Probabilistic Model, Measure of Relatedness, Term Weighting, Naive Bayes Text Classification, Document and Term Clustering, Flat and Hierarchical Clustering, Matrix Decomposition, Latent Semantic Indexing
Part B: Bayesian Model, Data Structures and Techniques for Ranking, Models for Browsing, Zipf's law, Heap's law

Unit 2: Query Processing and Retrieval Evaluation  
(8 Hrs)
Part A: Digital libraries, Morphological, Lexical Analysis, Stemming Algorithms, Thesaurus Construction, Ontology, Metadata, Query Languages, Similarity Measures and Ranking, Relevance Feedback, Query Expansion, Retrieval Performance, Evaluation Measures for Ranked and Unranked Results
Part B: Porter's Stemming Algorithm, Automatic Local/Global Analysis, Information Summarization and Visualization, Archiving and Preservation

Unit 3: Indexing and Searching  
(8 Hrs)
Part A: Automatic Indexing, Inverted Files, Structures Used, Signature Files, Compression, Partitioning, Tries, Suffix Trees and Suffix Arrays, Index Construction, Distributed Indexing, Index Composition, Sequential Searching, Pattern Matching, String Matching allowing Errors, Regular Expressions and Extended Patterns, Pattern Matching using Indices, Structural Queries
B. Fast Inversion (FAST-INV) Algorithm, Algorithms on PAT Tree, Faceted Search

Unit 4: Parallel, Distributed IR and Web Searching  
(8 Hrs)
Part A: Parallel IR, Index Construction, Distributed IR, Characterizing the Web, Search Engines, Browsing, Metasearchers, Searching using Hyperlinks, Crawling, Link Analysis, Architectures (Agents, Buses, Wrappers/Mediators)
Part B: Watermarking, PageRank Algorithm, HillTop Algorithm

Unit 5: Multimedia IR  
(7 Hrs)
Part A: Multimedia Data Modeling, Query Languages, A Generic Multimedia Indexing (GEMINI) Approach, One Dimensional Time Series, Two Dimensional Color Images, Automatic Feature Extraction, Operations on images, Motion detection, Object recognition, Automatic image annotation and retrieval, Audio, Graph, Video Retrieval
Part B: Hashing Algorithms, Image Features and Similarity Functions
Text Books

Reference Books
3. “Information Retrieval”, C. J. Van Rijsbergen, Information Retrieval Group, University of Glasgow, online at http://www.dcs.gla.ac.uk/Keith/Preface.html

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Construct various indexes using suitable techniques
2. Validate retrieval performance of an information retrieval system
3. Apply sequential search and pattern matching techniques
4. Describe various models for information retrieval system
5. Illustrate working of parallel, distributed and multimedia information retrieval system
6. Use various information retrieval algorithms and different types of queries to address real world challenges
CS42114:: PRODUCT DESIGN

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  
Introduction and User Studies  
(9+1 Hrs)


Part B: Selection of a Product for Design Study such as Antivirus, Operating System, Mobile Phones, Web Browsers, Accounting Software etc.

Unit 2:  
Design and Usability Evaluation  
(7+2 Hrs)


Part B: Ethnographic and Cultural Study of Selected Product.

Unit 3:  
Categorization of Products  
(8+2 Hrs)

Part A: Products for Future Use, Products to be Used in Groups, Devices used in Public Places, Products that Enrich User Experience, Embedded Products, Designer Products, Interfaces, Complexity of Interfaces, Design of Multi-Modal Interfaces, Expressive Interfaces, Natural Interfaces, Tangible Interfaces, Faulty Interfaces.

Part B: Classification of Selected Products and Possible Variances with Extended Features.

Unit 4:  
Design Management and Professional Practice  
(8+2 Hrs)

Part B: Identification of IPR (Copyrights, Patents and Trademarks) Issues with Selected Products.

Unit 5: (8+1 Hrs)

Product Life and Marketing


Part B: Analysis of Prices and Related Pricing Policy for Selected Product.

Text Books

Reference Books

Additional Reading

Course Outcomes:

Upon completion of the course, graduate will be able to -

1. Develop an IT product concept by applying suitable design principles, models and guidelines along with creativity.
2. Propose an implementation-centric product design with due consideration to ethnographic, cultural and accessibility aspects.
3. Formulate all possible vital product features required for a specific category of product
4. Propose effective pricing policy along with multilingual documentation and support for the product
5. Build a set of skills required for responsible positions such as Product Designer, Interaction Designer and Creative Technologist
6. Follow required processes and standards while designing IT products
CS42115:: HUMAN COMPUTER INTERACTION

Credits: 03  Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  (7+1 Hrs)
Introduction

Part B: Identification of Application Category and Related Features for Selected Product / System.

Unit 2:  (9+2 Hrs)
Principles, Models & Guidelines

Part B: Task / Error Analysis for Selected Product / System.

Unit 3:  (8+2 Hrs)
Design Process and Interaction Styles

Part B: UI Design for Selected Product/System.

Unit 4:  (8+2 Hrs)
Evaluation Techniques and Interface Categories

Interviews, Think Aloud, Acceptance Tests, Statistical Methods, Touch Interfaces, Public Place Interfaces, Wearable Interfaces, Tangible Interfaces, Intelligent Interfaces, Ubiquitous and Context-Aware Interaction.

**Part B:** Usability Evaluation of Selected Product/System.

**Unit 5:** (8+1 Hrs)

**Documentation and Groupware**

**Part A:** Classification of Documents, Printed Manuals, Reading from Displays, Online Help, Tutorial, Error / Warning Messages, Groupware, Goals / Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Communityware, Social Psychology, Social Networks, Social Networking Sites.

**Part B:** Documentation Design for Selected Product/System.

**Text Books**


**Additional Reading**


**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. Identify human factors and usability issues related with computing applications
2. Differentiate computing applications into categories based on human factors
3. Design a user interface by applying suitable design principles, models and usability guidelines
4. Integrate ethno-cultural and accessibility computing aspects into the user interface design.
5. Display the impact of usability evaluation and testing in computing applications
6. Follow required processes and standards while designing user interfaces
CS42134:: Modeling and Simulation

Credits: 3

Teaching Scheme: 3 Hours / Week

Unit 1: Process of Modeling and Simulation (8 Hours)
Part A: What is M&S, Need for Abstraction, Relationship between modeling and simulation Process of modeling: Problem identification and formulation, Real system data collection, Model development, Validation, Experiment design, Simulation runs and Results interpretation.
Part B: Application areas: optimization, decision making support, forecasting, safety considerations, training and education

Unit 2: Formal models and modeling techniques (8 Hours)
Part A: Monte Carlo methods, Stochastic processes, Queuing theory: Little's Theorem and applications, M/M/1 Queuing System, Markov Chain Formulation, the M/M/m, M/M/m/m and other Markov Systems, Non-markovian queue, Analytical Model Vs. Simulation model, Petri nets and colored Petri nets, Game theory, State spaces and transitions.
Part B: Graph structures: directed graphs, trees, networks

Unit 3: Discrete Event Simulation (8 Hours)
Part A: Deterministic vs. stochastic simulation, Static vs. Dynamic Simulation, Constructing dynamic stochastic simulation models, Time keeping, Event Scheduling, State transition, Time driven and event driven models, Pseudo-random number generation.
Part B: SimPy basics

Unit 4: Agent-based simulation (8 Hours)
Part B: NetLogo basics

Unit 5: Advanced Topics (8 Hours)
Part A: Intro to Parallel Discrete Event Simulation: Parallel and Distributed Platforms, Model scalability, Virtual Reality, Virtual Worlds, Intro to Rare Event Simulation.
Part B: PDES Challenges

Text Books:

Reference Books:

2. **Parallel and Distributed Simulation Systems, Fujimoto R.M., 2000, John Wiley & Sons.**

**Course Outcomes:**

Upon completion of the course, graduates will be able to –

1. Develop a model for a given problem using appropriate modeling and simulation technique/formalism.
2. Implement discrete event simulation models using general-purpose programming languages or DES frameworks.
3. Demonstrate the effectiveness of modeling and simulation at predicting behavior/performance/problems of systems under development.
4. Design an agent-based simulation model for a complex system.
5. Contribute towards increased utilization of modeling and simulation as a problem solving approach for issues in governance and industry where it could be applied.
6. Adapt to the changing needs of the organizations and individuals during the development process.
CS40215:: DISTRIBUTED COMPUTING

Credits: 01  
Teaching Scheme: -Tutorial 1 Hr/Week

Prerequisites: Operating Systems.

List of Contents

A TERM-WORK containing the record of the following:

1. Design and develop a basic prototype distributed system (e.g. a DFS).
2. Design and implement client server application using RPC/ RMI mechanism (Java)
3. Design and implement a clock synchronization algorithm for prototype DS.
4. Implement Ring or Bully election algorithm for prototype DS.
5. Ricart Agrawala’s distributed algorithm for mutual exclusion.
7. Simulate Wait for Graph based Centralized or Hierarchical or Distributed algorithm for deadlock detection.
8. Implementation of 2PC / Byzantine Generals Problem
9. Simulate any one of the Consistency models.

Text Books


Reference Books

2. “Distributed Systems – Concepts and Design”, George Coulouris, Jean Dollimore & Tim
Additional Reading

CS42125:: Randomized and Approximation Algorithms

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: Prior introduction to basic probability theory is helpful though it is not
presumed. First course on algorithms.

List of Contents

A TERM-WORK containing the record of the following:

Assignments:

1. Problem solving based on basic probability (random variables, mean, variance)
2. Problem solving based on basic probability (linearity of expectation, some applications, conditional probability)
3. Use of indicator random variables in algorithm analysis
4. Tail Inequalities and applications (Markov, Chebyshev)
5. Tail Inequalities and applications (Chernoff bound, variance of sum of co-related random variables)
6. Random walks, rapid mixing and some applications like sampling points from convex bodies
7. Schwartz-Zippel Lemma and applications
8. Complexity of perfect matching problem
9. Randomization in Number theoretic and geometric algorithms
10. Approximation algorithms, lower bounding OPT
11. Linear programming and LP-duality, LP based approximation algorithms
12. PCP theorem and hardness of approximation
Text Books
2. Approximation Algorithms by Vijay V. Vazirani (Springer)

Reference Books
CS42113:: DIGITAL SIGNAL PROCESSING

Credits: 01

Teaching Scheme: - Tutorial 1 Hrs/Week

Prerequisites:

List of Tutorials

1. Sampling theorem: Write a program in Matlab to verify sampling theorem

2. Linear Convolution: Write a program in Matlab to perform linear convolution of 2 user defined signals. Verify your answer using Matlab functions.

3. Cross co-relation: Get two signals from user and write a code in Matlab to perform cross co-relation. Verify your answer using Matlab functions.

4. Auto co-relation: Get a signal from user and write a program in Matlab to verify the following two properties of the Auto co-relation.
   A. Auto co-relation attains its maximum value at zero lag
   B. Auto co-relation is an even function

5. Pole Zero: For a given Z transform of signal, plot poles and zeroes on Z space using Matlab and verify that when for a system, if pole is near unit circle, rate of decay of the response in time domain is much more gradual than a system with pole near origin.

6. Magnitude and Phase response of a system: For a given transfer function, plot magnitude and phase response of the system using Matlab

7. DFT: Write a program to calculate 8 point DFT of a user defined signal using Matlab. Verify your answer using Matlab functions.

8. Circular Convolution: Get two signals from user and write a program in Matlab to calculate their circular convolution. Verify your answer using Matlab functions.

9. FFT: Write a program to implement a Radix 2, 8 Point DIT FFT algorithm using Matlab and verify your answer using in built functions.

10. IIR Filter design: Get the filter specification from the user and write a program to calculate the filter coefficients in C/C++
11. FIR Filter design: Get the filter specification from the user and write a program to calculate the filter coefficients in C/C++

**Text Books**


**Reference Books**


CS42219:: INFORMATION RETRIEVAL

Credits: 01

Teaching Scheme: - Tutorial 1 Hrs/Week

Prerequisites: Data Structures, Database Management Systems

List of Contents

A TERM-WORK containing the record of the following:

A. Assignments :
   1. Problem solving for Boolean model.
   2. Problem solving for Vector Space model.
   3. Study of Stemming Algorithms and Thesaurus Construction
   4. Problem solving for Index creation: Inverted Files, Signature Files, Suffix Trees and Suffix Arrays
   5. Problem solving for Sequential Searching and Pattern Matching techniques
   6. Problem solving for Latent Semantic Indexing for Text Classification
   7. Build an Information Retrieval system using Apache Lucene

Text Books


Reference Books

3. Apache Lucene Tutorial
CS42114:: PRODUCT DESIGN

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites:

List of Contents

A TERM-WORK containing the record of the following:

1. Design a questionnaire for study of selected product.
2. Study specialized user population and their impact on the design of selected product.
3. Perform a GOMS analysis for any task(s) related with selected product.
4. Study faulty interfaces/interactions related with selected product.
5. Analyze the cybercrimes related with selected product and suggest preventive measures.

Text Books


Reference Books


Additional Reading

CS42115:: HUMAN COMPUTER INTERACTION

Credits: 01  
Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: :

List of Contents

A TERM-WORK containing the record of the following:

1. Identify specialized users and related facilities for a selected product / system and make necessary suggestions for its improved accessibility design.

2. Design user persona for the users of selected product / system.

3. Conduct a contextual inquiry for selected product/system.

4. Design an interface prototype for selected product/system.

5. Evaluate an interface using usability evaluation technique.

Text Books

CS42234: Modeling and Simulation

Credits: 1
Teaching Scheme: Tutorial 1 Hours / Week

List of Contents:

1. Develop a simple deterministic simulation to determine the loan tenure for Rs.X principal amount when the customer pays Rs.Y per month. Assume the fixed interest rate of 10% per year.

2. Develop a Monte Carlo simulation model for profit estimation before introducing a new product in the market. Consider the uncertainty in terms of sales, production costs, competitive pricing and other market dynamics.

3. Develop a discrete event simulation of a typical fast-food restaurant. Restaurant configuration, business factors and customer behaviour factors should be tunable parameters.


5. Develop a parallel discrete event simulation for a network of routers using conservative event processing.

Text Books:


Reference Books:

CS40314: BUSINESS INTELLIGENCE AND ANALYTICS

Credits: 01  
Teaching Scheme: -Practical 2Hr/Week

Prerequisites: Database Management Systems.

List of Contents

A TERM-WORK containing the record of the following:

1. Getting started: understand what business do with their data with a scenario based application using QlikView tool
2. Designing an end to end warehousing solution for a real world scenario involving multi-dimensional modeling, designing data cube, doing ETL, OLAP and reporting
3. Getting started with R
4. Using R for data preprocessing, exploratory analysis, visualization, correlation and regression analysis, hypothesis testing, chi square test
5. Data analysis case study using R for a readily available data set
6. BigData Analytics - MapReduce and exposure to Hadoop. Using R over Hadoop
7. [Optional] A group mini-project: take a real world data analysis problem and solve it using the above learned concepts
   a. Getting Data from varied sources
   b. Data massaging to prepare it for analysis
   c. Generating visualizations to interpret descriptive analysis
   d. Implementing sampling and estimation techniques
   e. Regression analysis on data
   f. Hypothesis testing
Text Books
1. “Data mining and business analytics with R”, Johannes Ledolter, Wiley
2. “Business Analytics” by James R Evans, Pearson

Reference Books
1. “Business Intelligence for Dummies”
5. “Information Dashboard Design: The effective visual communication of data”, Stephen Few, O’Reilly
CS42305:: MOBILE COMPUTING

Credits: 01  
Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Computer Networks

List of Practical

Assignments should be implemented on android operating systems.

1. Design simple GUI application with activity and intents e.g. calculator.
2. Design an application to handle address book and call log.
3. Design an application to display map with current location.
4. Design an application to send SMS and emails.
5. Design a client server application to communicate with database server.

Course Project: The project needs to be done in the group of 2 or 3 where students need to select real world problem and present a solution. During the evaluation of the project the emphasis is on: (a) how problem selection is done and (b) is the application user friendly.

Text Books

Reference Books
CS42331::Enterprise Systems

Credits: 01  
Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites: Software Engineering, Database Management System

List of Practical

2. To decompose and organize the problem domain area into broad subject areas and identify the boundaries of problem/system along with identification of Business Processes and develop full detail Business Process diagrams.
3. To develop Domain-driven vocabulary of the target system indicating domain lexicon and context-based terminologies.
4. To identify and categorize the target system services with detailed service specifications modeled with component diagram incorporating appropriate architectural style and coupling.
5. To design the service layers and tiers modeled with deployment diagram accommodating abstraction, autonomy, statelessness and reuse.
6. To map the service levels and primitives to appropriate Strategies for data processing using XML / XQuery/ JSON / JAXB.
7. To produce, invoke, compose Web Services using SOAP, WSDL and UDDI.
8. To implement and integrate the components of the target system using .NET / J2EE platforms adhering to Service specifications.
9. To create the balanced scorecard for the target system indicating the standards and principles applied.

Text Books:


Reference Books:


CS42327 :: CLOUD COMPUTING

Credits: 01  
Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites: Computer Networks, web Technology, Operating Systems.

List of Contents

A TERM-WORK containing the record of the following:

1. Hands on virtualization using XenServer
2. Hands on containerisation using Docker
3. Deployment and Configuration options in Amazon (AWS)
4. Deployment and Configuration options in Google Cloud
5. Deployment and Configuration options in Microsoft Azure
6. Building a 'HelloWorld' app for the cloud
7. Deploying the 'HelloWorld' app for the cloud

Text Books
2. Enterprise Cloud Computing by Gautam Shroff, Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

Reference Books

1. Google Apps by Scott Granneman, Pearson
2. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD, O'REILLY)
4. Cloud Computing Bible by Barrie Sosinsky, Wiley India
CS42303: PARALLEL COMPUTING ON GPU

Credits: 01  Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites:

List of Practical

1. Parallel GPU implementation of vector-vector operations
2. Parallel GPU implementation of vector-Matrix operations
3. Parallel computation of binomial coefficient matrix
4. Parallel GPU implementation of Matrix-Matrix operations
5. Assignment focusing on optimization of data transfer between CPU and GPU: using page locked host memory and to avoid the data transfer
6. Assignment focusing on memory optimization: use of GPU shared, constant and texture memory.
7. Parallel GPU implementation involving kernel looping.
8. Parallel computation of set of multi-indices on GPU.

Text Books

2. CUDA by Example: An Introduction to General-Purpose GPU Programming by Jason Sanders and Edward Kandrot
3. Parallel Programming in C with MPI and OpenMP by Michael J. Quinn, Tata McGraw-Hill Edition

References:

http://developer.nvidia.com/
www tutorials on introduction to parallel computing

Other references suggested by instructor
CS42312: NETWORKS SECURITY

Credits: 01  |  Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practicals

1. Demonstrate: SQL injection, Cross-site scripting, buffer overflow.

2. Implement packet sniffer.

3. Implementation of Caesar and Vigenere Cipher

4. Implementation of Playfair Cipher

5. Implementation of Hill Cipher

6. Implementation of S-DES.

7. Implementation of S-AES

8. Implementation of RSA.

9. Implementation of Diffie-Hellman key exchange

10. Implementation of ECC algorithm.

Text Books


Reference Books

Additional Reading
CS42301:: ADVANCED COMPUTER GRAPHICS

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practical

1. Implement an OpenGL program to draw different 2D shapes.

2. Implement an OpenGL program to draw 2 overlapped shapes and use alpha blending.

3. Implement an OpenGL program to draw 3D cube and apply transformations.

4. Implement an OpenGL program to draw 12 spheres and apply different light effects.

5. Implement an OpenGL program to draw scene and apply fog effect.

6. Implement an OpenGL program to draw 3D cube and apply different textures on different faces.

7. Implement CUDA program for the prefix addition.

8. Implement CUDA program for the multiply two matrices.


10. Implement a program for edge detection using Gaussian filter.

Text Books


1.

Reference Books

Additional Reading
CS47303:: PROJECT STAGE 2

Credits: 04  
Teaching Scheme: - Practical 8 Hrs/Week

Aim
This course addresses the issues associated with the successful management of a software development project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and their career. The Project Work can lead to:

a. Transform existing systems into conceptual models.
b. Transform conceptual models into determinable models.
c. Use determinable models to obtain system specifications.
d. Select optimum specifications and create physical models.
e. Apply the results from physical models to create real target systems.

Overview of the Course:

1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student’s own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.
3. The project must be open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.
7. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate’s performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.

8. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.

Assessment Scheme

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<thead>
<tr>
<th>Sr. No.</th>
<th>Content</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
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<td>Feasibility Study</td>
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<td>System Design</td>
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<tr>
<td>5</td>
<td>Presentation of the Project Work</td>
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Note:
The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members.

The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted. Following is the list of recommended domains for Project Work:

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Model the Real World Problem
2. Identify the Design within Specification and Available Resources
3. Realise the Solution within Defined references
4. Defend his Design with Technical and Ethical reasoning
5. Adapt to changing Technological and Human resource advances
6. Use the gained knowledge for other Real World Problems
MODULE VIII
### S.Y. B. Tech. Structure with effect from Academic Year 2015-16

#### Module VIII

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Type</th>
<th>Teaching Scheme</th>
<th>Assessment Scheme</th>
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TOTAL 22
CS40106:: COMPILER DESIGN

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Theory of Computation.

Unit 1: (8+1 Hrs)
Lexical Analysis and introduction to Syntax Analysis

Part B: Implementing Scanners, operator precedence parsers.

Unit 2: (8+1 Hrs)
Syntax and Semantic Analysis

Part A: Bottom-Up Parsing, LR Parsers: constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, YACC, Type Checking, Type Conversion.
Part B: Symbol-Table Structure.

Unit 3: (8+1 Hrs)
Syntax-Directed Translation and Intermediate Code Generation

Part B: More about translation: Array references in arithmetic expressions, case statements.

Unit 4: (8+1 Hrs)
Code Generation

Part B: Generating code from dags.

Unit 5: (8+1 Hrs)
Code Optimization and Run Time Environments


Text Books

Reference Books

Additional Reading

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Identify and Interpret the different phases of a compiler and their functioning.
2. Design a well-structured system to ensure the syntactic and semantic correctness of a program.
3. Acquaint themselves with compiler writing tools.
4. Propose techniques and performance bound solutions to address real world problems in language processing.
5. Develop compiler for a subset of a programming language with collaborative efforts.
6. Apply classical compilation principles and techniques to implement various phases of compiler which conforms to the underlying programming language specifications.
CS40110: Artificial Intelligence

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: Fundamentals of Artificial Intelligence (8 Hrs)


Part B: Criteria for Success, Turing Test.

Unit 2: Searching (8 Hrs)

Part A: Depth First Search, Breadth First Search, Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means-Ends Analysis. Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence

Part B: Applications of Minimax Algorithm.

Unit 3: Planning (8 Hrs)


Part B: Planning Graph

Unit 4: Knowledge Representation (8 Hrs)

Part A: Knowledge based agents, Wumpus world, Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining

First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.


Part B: Case study of Expert System in PROLOG

Unit 5: Uncertainty (8 Hrs)


Part B: Basis of Utility Theory, Utility Functions.

Text Books


Reference Books

2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2. Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
4. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
5. Use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.
CS42120 :: DATA MINING

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Database Management Systems.

Unit 1: (9+2 Hrs)
Data Mining and Preprocessing

Part A: Introduction: Need of Data Mining, Knowledge Discovery in Database (KDD), Architecture of Data Mining System; Data Objects and Attribute Types, Statistical Description of Data, Data Visualization

Data Preprocessing: Central Tendency, Data Dispersion, Data Summarization, Cleaning, Integration, Transformation, Reduction, Discretization, Binarization, Variable Transformation

Part B: Relation of Data Mining with Business Intelligence and Business Analytics, Integration of Data Mining with a Database or Data Warehouse System, Basics of Business Intelligence and Data Warehousing, Issues in Data Mining

Unit 2: (7+1 Hrs)
Mining Frequent Patterns, Association and Correlations

Part A: Frequent Itemset Mining: Interesting Item Set Mining: Market Basket Analysis, Generating Association Rules, Apriori Algorithm, A pattern growth approach for mining frequent item set, Mining frequent item-sets using vertical data, Evaluation of Association Patterns, From Association Analysis to Correlation Analysis

Part B: Sequential Pattern Mining Algorithms, Pattern mining in multi-level, multi-dimensional space

Unit 3: (9+2 Hrs)
Classification and Prediction

Part A: Classification: Decision Tree Classifier, Rule Based Classification, Bayesian Classification, Neural Network Classification: Back Propagation Algorithm, Lazy Learner: kNN Classifier, Support Vector Machine Model Overfitting, Classifier Accuracy Measures, Techniques for Evaluating Classifier Accuracy, Ensemble Methods, Multiclass Problem

Prediction: Linear, Non-Linear Regression

Part B: Case-Based Reasoning, Associative Classification, Other Classification Techniques: Genetic Algorithm, Fuzzy Set Approach, Rough Set, Constraints Based Association Mining.

Unit 4: (8+2 Hrs)
Clustering and Outlier Detection
Part A: Cluster Analysis: Categories of Clustering methods, Different Types of Clusters, Partitioning methods: k-Means, k-Medoids; Hierarchical Clustering Methods: BIRCH, Chameleon; Grid Based Methods: STING; Density based Clustering: DBScan Cluster Evaluation

Outlier Analysis: Types of outlier, Proximity based approach: distance based , Density based approach

Part B: Grid Based Methods: CLIQUE, Density based Clustering: OPTICS, Deviation based outlier detection approach: grid based

Unit 5: (7+1 Hrs)
Data Mining on different Databases

Part A: Multimedia Data Mining, Web Mining, Text Mining, Spatial Data Mining, Mining on Social Networks, Multirelational Data Mining.

Part B: Graph Mining , Mining Time – Series Data, Data Mining Applications

Text Books
2. “Introduction to Data Mining”, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson

Reference Books

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Identify different preprocessing techniques required for analysis of given dataset
2. Derive useful facts from data using different data mining algorithms
3. Apply suitable data mining toolkit/s to predict useful patterns
4. Illustrate use of appropriate analysis technique/s given the data specifications
5. Participate in applying relevant technology for societal benefit
6. Co-operate with team members to solve complex analysis problems
CS42128: MACHINE LEARNING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Artificial Intelligence.

Unit 1: Fundamentals (7 Hrs)

Part-A:

Soft computing and hard computing, types of learning, activation functions, Learning Rules, Mc-Culloch-pitts Neuron model, single layer and multilayer perceptron, Backpropagation algorithm, Well posed learning problem, Designing a learning system, Perspectives and issues in soft computing,

Part B: Solving Problems based on above algorithms.

Unit 2: Concept and decision tree Learning (7 Hrs)

Part-A:

Concept Learning, General-to-Specific Ordering: Task, search, Find S algorithm, Version space and the candidate elimination algorithm, list then eliminate algorithm, inductive bias, Decision Tree Learning: representation, Basic decision tree learning algorithm, Hypothesis space, Issues in decision tree learning.

Part B: Solving Problems based on above algorithms.

Unit 3: Evaluating Hypothesis (6 Hrs)

Evaluating Hypotheses, Evaluating hypothesis accuracy, Sampling theory, Central limit theorem, hypothesis testing, comparing learning algorithms. Bayesian Learning, Bayes theorem, Maximum likelihood hypothesis, minimum description length principle, Gibbs algorithm, Bayesian belief networks, Expectation maximization algorithm.

Part B: Solving Problems based on above algorithms.

Unit 4: Machine Learning Algorithm

Hidden markov model, Genetic algorithm, SVM, Kernel functions, Linear SVM,
Nonlinear SVM, Regression analysis, ensemble classifiers, Validation, evaluation.

Part B: Solving Problems based on above algorithms.

Unit 5: (7 Hrs)
Clustering Algorithm and recurrent Networks

Part-A: k-means algorithm, k-nearest neighbor learning, weighted majority algorithm, Hopefield Net, Hamming net, Maxnet, Kohonen self organizing map, Principal component Analysis (PCA), Applications of machine learning.

Part B: Solving Problems based on above algorithms, locally weighted regression.

Text Books

Reference Books
3. Research papers suggested by the faculty.

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Evaluation of different algorithms on well formulated problems along with stating valid conclusions that the evaluation support.


3. Demonstrate knowledge of supervised, unsupervised and reinforcement Machine Learning algorithms through implementation for sustainable solutions of applications.

4. Apply different Mathematical models used in machine learning to specific multidisciplinary domains.

5. Formulate a given problem within the framework of different machine learning methods with focus on building lifelong learning ability.

6. Analyze research based problems using Machine learning techniques.
CS42104:: NEURAL NETWORKS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  
Introduction  
(8+2 Hrs)

Part A: Introduction and Role of Neural Network (NN), Applications: Signal Processing, Pattern recognition, Medicine, Speech Production/Recognition, Business etc., Artificial Neural Networks, Biological Neural Networks, Components of Neural Network, Network topologies, Linear Separability, Hebb Net, Perceptron, Adaline/Madaline, Paradigms of Learning: Unsupervised, Reinforced, Supervised, Competitive, Offline or Online, Activation Functions  
Part B: Examples on Learning.

Unit 2:  
The Perceptron, Backpropagation and other Neural Networks  
(8+1 Hrs)


Unit 3:  
Competitive Neural Network  
(8+2 Hrs)

Part B: Applications of Self organizing Maps

Unit 4:  
Adaptive Resonance Theory(ART)  
(8+1 Hrs)

Part B: Case Study: ART2 Application

Unit 5:  
Pattern Association  
(8+2 Hrs)
Part A: Training Algorithm for Pattern association, Heteroassociative Memory Neural Network, Auto associative Neural Network, Iterative Auto associative Neural Network, Discrete Hopfield Network, Bidirectional associative Memory (BAM),

Part B: Perceptron Case Study

Text Books

Reference Books

Additional Reading

Course Outcomes:

Upon completion of the course, graduates will be able to –

1. To Understand a number of models for supervised, unsupervised, and reinforcement neural networks systematically.
2. student should able to analyze different algorithms according to the properties of their inputs and outputs using different types of big data.
3. Design the most appropriate neural network for classification, Clustering, automatic detection and optimization.
4. Implement the algorithms in a software environment using MATLAB / Neural ware Professional and R-Programming Language.
5. To evaluate the neural network algorithms
CS42111: Software Testing and Quality Assurance

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Software Engineering, Database Management System

Unit 1:: Software Measurement (8 Hrs)
Part B: The Rayleigh Model, Exponential Distribution and Reliability Growth Models, SRE process, Reliability Concepts: Hardware and Software, Deploying SRE

Unit 2:: Principles of Testing (8 Hrs)
Part B: Analysis of Flow Graphs, Complexity Measures and computations

Unit 3:: Functional Testing (8 Hrs)

Unit 4:: Higher Order Testing (8 Hrs)


Unit 5:: Software Quality Assurance ( 8 Hrs )


Part B: Software Benchmarks and Baselines, Key Factors for Software Assessment and Benchmark Studies, Identifying Software Best and Worst Practices

Text Books:


Reference Books :


Course Outcomes:

Upon completion of the course, graduates will be able to –

1. Judge application of software measurement theory and comprehend evaluative options.
2. Infer problem levels so as to prioritize them based on commonly acceptable evaluation practices.
3. Devise a framework to hypothesize the desirable outcomes by application of suitable testing techniques and strategies.
4. Conform to well documented specification in order to defend the practicability of solution sustainment.
5. Demonstrate the skillset as a tester to neutralize the consequences of wicked problem.
6. Creatively adapt to new segments uprising in testing arena.
CS42124:: ALGORITHMIC NUMBER THEORY AND ALGEBRA

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Basic introduction to linear algebra and abstract algebra (though it is not presumed) is helpful to better appreciate the contents of the course. First course on algorithms.

(8+2 Hrs)

Unit 1:
Basic Number Theory

Part A: Infinitely many primes in \( \mathbb{Z} \) (some proofs), greatest common divisor, unique factorization of integers, modular arithmetic, (some results on modular arithmetic: Fermat’s little theorem, Wilson’s theorem, … etc), linear congruences and Chinese Remaindering Theorem, linear Diophantine equations, some arithmetic multiplicative functions (e.g. Euler's phi function, Mobius function, divisor function…), Dirichlet convolution, Mobius inversion. Quadratic residues, Legendre symbol, Gauss’ law of Quadratic reciprocity. Distribution of primes, Prime number theorem.

Part B: More Diophantine equations (e.g. Pell’s equation), more results on distribution of primes (proving lower and upper bound (asymptotic) on \( \pi(x) \), where \( \pi(x) \) is number of primes up to \( x \))

(8+1 Hrs)

Unit 2:
Basic abstract Algebra

Part A: Groups, subgroups, Lagrange’s theorem, group homomorphism, quotient groups, normal subgroups, cyclic groups, Abelian groups and their decomposition, rings, ideals, some examples of rings (e.g. polynomial ring \( F[x] \), ring of integers modulo \( n \)), units and zero divisors in the ring, structure of unit group of \( \mathbb{Z}_n \), integral domains, fields, vector spaces. Unique factorization in ring \( \mathbb{Z}[i] \) where \( k \) is a field, Principal Ideal Domains(PID).

Basics of finite fields: existence of finite fields of size \( p^n \) for \( n > 0 \), \( p \) prime, isomorphism of finite fields of same size, structure of multiplicative group, field automorphisms, Frobenius maps.

Part B: Ring of Gaussian integers \( \mathbb{Z}[i] \) and Lagrange’s four square theorem, analogies between ring of integers and univariate polynomial ring, more properties of finite fields.

(8+2 Hrs)

Unit 3:
Number theoretic algorithms


Univariate polynomial arithmetic (multiplication, gcd, etc), irreducibility testing for...
polynomials in $F[x]$ where $F$ is finite field, ring $F[x]/(f)$, modular inverse computation.

**Part B:** Chinese Remaindering and computing determinant of integer matrix, Euclid’s algorithm and Fibonacci numbers (a detailed analysis of Euclid’s algorithm), Some more algorithmic questions over finite fields.

**Unit 4:**

**Polynomial Factorization**

**Part A:** Univariate polynomial factorization over finite fields: revisit unique factorization, Randomized polynomial time algorithms:

a. Berlekamp’s algorithm: linear algebra preliminaries for Berlekamp’s algorithm, Frobenius map, the algorithm, resultants and some implications of Berlekamp’s algorithm, parallel algorithm for computing gcd of polynomials.

b. Cantor-Zassenhaus algorithm: distinct degree and equal degree factorization, CRT and Cantor-Zassenhaus algorithm.

Geometry of Numbers and polynomial factorization over rationals: Basics on integer lattices, Minkowski’s theorems, algorithmic questions over integer lattices (Closest Vector Problem and Shortest Vector Problem) Gauss’ algorithm for SVP in 2 dimensions. Lenstra-Lenstra-Lovasz(LLL) approximation algorithm for SVP. Deterministic polynomial time algorithm for factorization of univariate polynomials over rational (using LLL and Hensel lifting lemma)

**Part B:** Reduction of polynomial factorization problem to root finding using Berlekamp’s algorithm. Recent deterministic sub-exponential time algorithm for the

**Unit 5:**

**Primality**

**Part A:** Pratt’s result: PRIMES in NP intersection coNP, randomized polynomial time algorithms:

a. Miller-Rabin primality test: Carmichael numbers, derandomizing Miller-Rabin test using Riemann Hypothesis, computing a factor of a number given phi(n) where phi is Euler’s totient function.

b. Solovay-Strassen primality test: Jacobi symbol, quadratic reciprocity, Solovay-Strassen primality test.-

Prime number theorem and generating large primes (application to RSA crypto system)

**Part B:** Agarwal-Kayal-Saxena(deterministic polynomial time) primality test.

**Text Books**

1. *Modern Computer Algebra by Joachim von zur Gathen, Jürgen Gerhard (Cambridge)*
2. *A computational introduction to Number Theory and Algebra* by Victor Shoup (Cambridge)

3. *A classical introduction to modern number theory* by Ireland and Rosen (Springer)

**Reference Books**

1. *Topics in Algebra* by I. N. Herstein (Wiley Publishing company)

2. *Algebra* by Michael Artin (Pearson Prentice Hall)

**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. To solve mathematical problems based on elementary number theory
2. To describe various algebraic structures such as groups, rings, fields, vector-spaces and their interrelation
3. To design efficient algorithms for various number theoretic and algebraic computational problems
4. To evaluate various known algorithms for multivariate polynomial factorization over finite fields and field of rationals
5. To describe efficient algorithmic solutions for shortest vector problem over integer lattices and their applications
6. To explain various issues arising in designing efficient algorithms for testing primality of a natural number
CS42118:: GEOGRAPHICAL INFORMATION SYSTEMS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  
GIS and Maps


Part B: Selection of a GIS Application in Various Domains such as Weather Forecasting, Urban Planning, Agriculture, Defense, Network Applications.

Unit 2:  
Remote Sensing Fundamentals


Part B: Study of Satellites such as IRS, OCEANSAT-1, IKONOS etc.

Unit 3:  
Image Processing


Part B: Study of GIS Hardware and Software required specially for Image Processing.

Unit 4:  
Spatial Data Modeling and Management

Part A: Spatial Data Modeling: Stages of GIS Data Modeling, Graphic Representation of Spatial Data, Raster GIS Models, Vector GIS Models, GIS Data Management: Database

**Part B:** Design a Spatial Database for a Selected Application.

**Unit 5:**

**Data Input, Quality and Analysis**

**(8+1 Hrs)**

**Part A:** Data Input and Editing: The Data Stream, Data Input Models, Data Input Methods, GPS for GIS Data Capture, Data Editing. Data Quality Issues: Components of Data Quality, Accuracy, Precision and Resolution, Consistency, Completeness, Sources of Error in GIS, GIS Output, Modeling Errors and Error Evaluation. Data Analysis and Modeling: Format Conversion, Data Medium Conversion, Spatial Measurement Methods, Buffering Techniques, Overlay Analysis, Modeling Surfaces.

**Part A:** Identification of Data Inputs Outputs and Study of Required Analytical

**Text Books**


**Reference Books**


**Additional Reading**


**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. Differentiate among map projections for geographical areas
2. Design spatial data model for geographical area encompassing related entities
3. Create database for geographical area encompassing related entities using GIS software
4. Propose effective remote sensing based solutions addressing requirements in domains such as urban planning, weather forecasting, defense and land management
5. Display the impact of data processes such as data input, quality, analysis and output in GIS applications
6. Build skill set required for responsible positions such as GIS Analyst, GIS Technician and GIS Specialist
CS42129: MANAGEMENT INFORMATION SYSTEMS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1:  
Foundations of Information Systems  
(8+2 Hrs)

B. Selection of a Domain: Banking, Healthcare, Hotel, Telecom, Education, Agriculture, Shopping Mall, Automobile, Food Industry etc.

Unit 2:  
Manufacturing and Service Systems  
(8+2 Hrs)

B. Identification of Functional Levels, Services and Products in Selected Domain.

Unit 3:  
e-Business  
(8+2 Hrs)

B. Study of Process to accommodate e-Business Approach in Selected Domain.

Unit 4:  
Information Systems for Decision Support  
(8+2 Hrs)

A. Business and Decision Support, Decision Making Process, Components of DSS, MIS, Difference between DSS and MIS, Online Analytical Processing, Types of DSS, Using DSS, What-if analysis, Sensitivity analysis, Goal-seeking analysis, Optimization analysis, Data Mining for Decision Support, Executive Information Systems, Knowledge Management
B. Identify Decision-making Aspects in a Selected Domain with Appropriate Examples.

Unit 5: Challenges Ahead

Part B: Study of Cybercrimes and Preventive Measures w. r. t. Selected Domain.

Text Books

Reference Books

Additional Reading

Course Outcomes:

Upon completion of the course, graduates will be able to -
1. Estimate the functional complexities in manufacturing and service sectors for implementation of Management Information Systems
2. Differentiate management information systems based on their features and applicability
3. Initiate ethically responsible behavior as a professional
4. Respond positively to cultural, political and economical organizational challenges
5. Build a set of skills required for responsible positions such as System Analyst, Business Consultant and Information System manager
6. Follow required domain-specific processes and standards for management information systems
CS42121: ADVANCED COMPUTER ARCHITECTURE

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Computer Organization

Unit 1: (8+1 Hrs)
Overview of Parallel Processing


Unit 2: (8+1 Hrs)
Pipelining Processing

Part A: Principles and implementation of Pipelining, Classification of pipelining processors, Pipeline Architecture, Study and comparison of processors with and without pipelining. General pipelining reservation table, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision, Advanced pipelining techniques, loop unrolling techniques, out of order execution, software scheduling, trace scheduling.

Part B: Advances in pipeline architectures. Implementation issues of a program on any pipelined processor their analysis.

Unit 3: (8+1 Hrs)
SIMD Computer Organization and Parallel Algorithms For Array Processors

Part B: Implementation issues of Matrix multiplication and sorting on array processor and their analysis.

Unit 4: (8+1 Hrs)

Multiprocessor

Part A: Microprocessor Architectures, study and comparison of Loosely and Tightly coupled multiprocessors.
Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors, Inter Processor communication network, Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP), Cow’s and NOW's Cluster and Network of Work Stations), Chip Multiprocessing (CMP).

Part B: Implementation issues of a program on multiprocessor system

Unit 5: (8+1 Hrs)

Parallel Programming Techniques

Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming.

Part B: Implementation issues of a multithreaded program.

Text Books


Reference Books

1. Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
5. Richard Y. Kain, Advanced Computer Architecture

Course Outcomes:

Upon completion of the course, graduates will be able to -
1. Describe the principles of computer design.
2. Improve the performance of applications on modern and high performance computers.
3. Compare the performance of different architectures.
4. Develop applications for high performance computing systems.
5. Design solutions to computing problems using alternative architectures.
6. Analyze architectures performance and select among different ones for particular use scenarios.
CS42116 :: CONVERGENCE TECHNOLOGIES

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Computer Networks.

Unit 1: (7+2 Hrs)
Introduction to Convergence
Part A: what is network Convergence, the promise of network convergence, networking issues and convergence, Voice and data network characteristics, benefits of IP centric network, challenges of converged network, introduction to VOIP, applications of converged networks, VOIP implementation challenges.
Part B: voice and data network growth factor, effects of network convergence on businesses.

Unit 2: (9+1 Hrs)
Protocols and Standards for Convergence
Part A: Protocols Supporting VOIP: Multicast IP, RTP, RTCP, RSVP, RTSP, SDP, SAP, SIP.
Subscriber Lines: T1/T3, DS0, DS1, DS3, E1/E3.
Signaling Standards: H.323, SIP. Gateways, Gatekeepers.
Part B: MGCP, Audio and Video Codecs.

Unit 3: (9+1 Hrs)
Switching networks
Part A: ISDN: conceptual view of ISDN, transmission structure, user-network interface configuration, ISDN Protocol Architecture, ISDN connection, Addressing, Interworking, PRI, BRI, LAPD,
Basic Call control, SS7.
B-ISDN standards, Broadband services, B-ISDN architecture, B-ISDN protocol reference model.
Part B: ISDN standards, SDH.

Unit 4: (7+1 Hrs)
Frame Relay and SMDS
Part A: Frame Relay Circuits, Frame mode protocol architecture, frame mode call control, LAPF, Congestion in frame relay networks, approaches to congestion control, Traffic rate management, Explicit congestion avoidance, implicit congestion control.
SMDS: introduction to SMDS, SMDS interface protocol, SMDS addressing.
Part B: Comparison of SMDS with other LAN technologies.

Unit 5: (8+1 Hrs)
ATM technology

Part A: ATM VPI & VCI, Creation of virtual channel, Definitions of Virtual circuit and permanent virtual circuit, ATM reference model, step-by-step PVC example of how ATM network processes cells, AAL, Adaption layer from voice over ATM perspective AAL1, AAL2, AAL3, Connection admission control (CAC). Cell Loss Priority (CLP), ATM and convergence technology.

Part B: ATM versus Frame relay, ATM versus SONET.

Text Books

Reference Books

Additional Reading

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Categorize voice and data networks based on various protocols.
2. Analyze the protocols and standards for converged networks.
4. Design the converged network to fulfill the societal requirement.
5. Judge the impact and benefits of converged network in exploitation on environment and society.
6. Prepare cost effective solutions to fulfill the need of convergence technology.
CS42130 :: EMBEDDED SYSTEMS

Credits: 03  Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Understanding of Microprocessors, Peripheral Chips, Conversion, Interfacing Techniques.

Unit 1:  Introduction to Embedded Systems  (8+1 Hrs)
Part B: Memory Selection Criterion

Unit 2:  Bus Design  (8+1 Hrs)
Part B: Study of RS 232C , Centronics and USB

Unit 3:  Microcontroller Support Units  (8+1 Hrs)
Part A: Details of Components of Embedded Systems-Management of Power Supply, Clocking Unit, Real Time Clock and Timers, Reset Circuitry and Watchdog Timer. Structural Units of Processor, Processor and Memory Selection, Memory Map Of Embedded System, Interfacing Processors , Memories and I/O, Processor , Memory Map Of Embedded System
Part B: Design Parameters problem solving. PWM ADC Timers

Unit 4:  I/O Interfacing  (8+1 Hrs)
Part A: I/O interfacing and Communication I/O devices, ADC / DAC, Optical Devices such as LED / LCD Display devices, Opto-Isolator, Relay & stepper motor, Timers/Counters. Parallel v/s serial communication. Parallel ports their uses in device interfacing.
Part B: Design Implementation of OP Amps

Unit 5:  RTOS  (8+1 Hrs)
Part B: Case Study of Embedded Systems in Detail.(H/W + S/W Algo)
Text Books

Reference Books

Additional Reading
1. Microcontroller Handbook
6. Tammy Noergaard, — Embedded Systems Architecture by Elsevier

Course Outcomes:
Upon completion of the course, graduates will be able to -
2. Design system interconnects for effective throughput.
3. Create designs using Simulation and RTOS Tools.
5. Cooperate with diverse Teams for delivering automation Solutions.
6. Adapt to ever changing technological Advances.
CS42133 :: IMAGE PROCESSING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: Introduction to image processing (8+1 Hrs)

Part A: Components of image processing system, Scenes and Images, Vector Algebra, Orthogonal Transform, Human Visual System, color vision color model: RGB, HVS, YUV, CMYK, and some basic relationships between pixels, linear and non linear operations.
Part B: Application of different color models in Image processing.

Unit 2: Image Formation and Digitization (8+1 Hrs)

Part B: Overview of application of Image processing.

Unit 3: Image Processing (8+1 Hrs)


Unit 4: Image transform (8+1 Hrs)

Part A: Introduction to two dimensional orthogonal and unitary transforms, properties of unitary transforms one-two dimensional discrete Fourier Transform (DFT), Wavelet transforms. Cosine, sine transforms.

Unit 5: Compression fundamental (8+1 Hrs)

Part B: Elements of information theory, error free compression: VLC, JPEG compression standards Factral.

Text Books

Reference Books

Course Outcomes:
Upon completion of the course, graduates will be able to -
1. Convert gray scale image into colour image.
2. Describe the components of image processing system.
3. Implement algorithms for digital image processing.
4. Apply lossless and lossy compression techniques for image compression.
5. Design filters for image sharpening and smoothening.
6. Develop simple Programs to perform various operations on image.
CS4220 :: DATA MINING

Credits: 01  
Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: Database Management Systems.

List of Contents

A TERM-WORK containing the record of the following assignments:

Implementation of following data-mining tasks using a suitable Data Mining Toolkit:
1. Data Preprocessing
2. Association Mining Algorithms
3. Classification Algorithms
4. Linear Regression
5. Clustering Algorithms

Text Books

2. “Introduction to Data Mining”, Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson

Reference Books

CS4228 :: MACHINE LEARNING

Credits: 01

Teaching Scheme: -Tutorial: 1 Hr/Week

List of Tutorials

1. Implementation of learning algorithms like Find S algorithm, Version space and the candidate elimination algorithm, list then eliminate algorithm for simple real world problems.
2. Implementation of learning algorithms like Backpropagation algorithm, Support Vector Machines for real time problems.
3. Implementation of algorithms like Evaluating hypothesis accuracy, Sampling theory, Central limit theorem, hypothesis testing for real time problems.
4. Implementation of learning algorithms like Bayesian Learning for real time problems.
5. Implementation of learning algorithms like weighted majority algorithm, Instance-Based Learning: k-nearest neighbor learning, locally weighted regression for real time problems.
7. Implementation of learning algorithms like unsupervised or reinforcement learning for real time problems.
8. Implementation of Fuzy logic for real time problems.
9. Presentations on selected research topics.
10. A mini project for a real problem.

Text Books

2) Randy L. Haupt and Sue Ellen Haupt, Practical Genetic Algorithms.

Reference Books

3). Research papers suggested by the faculty.
CS42204 :: NEURAL NETWORKS

Credits: 01

Teaching Scheme: -Tutorial: 1 Hr/Week

List of Tutorials:

Minimum eight experiments based on the following topics.
1. Supervised Learning rules for a single neuron
2. Unsupervised Learning rules.
3. Simple Perceptron classifier
5. Backpropagation algorithm
6. MAXNET
7. Hamming Distance Classifier
8. Hopfield network
9. SOM
10. SVM
11. Verification of logic gates using NN algorithms
12. Feature extraction for a given real world problem of importance.
14. Two short assignments based on research papers suggested by staff.

Text Books

3. Prof. Dr. S. T. Patil, Neural Networks and applications, Nirali Prakashan, Pune.

Reference Books

5. John Yen and Reza Langari, “Fuzzy logic, intelligence, control and information”.
7. Some basic and modern research papers suggested by staff in charge.
CS42211: Software Testing and Quality Assurance

Credits: 01

Teaching Scheme: - Tutorial 1 Hrs/Week

Prerequisites: Software Engineering

List of Contents

A TERM-WORK containing the record of the following:

1. To Prepare Test Plan for the given problem. The Test plan consists of following issues.
   a. Purpose of the test.
   b. Location and schedule of the test.
   c. Test descriptions.
   d. Pass and Fail Criteria.
2. To identify and narrate Test cases, Test scripts/procedures.
3. To perform Unit testing especially indicating the traced Independent data paths, Control paths and Error handling paths. Prepare control flow graphs for the unit under test and compute the Cyclomatic Complexity of the unit.
4. To perform Data Flow testing for the Program Segments by identifying the Definition-Use chain and type of data flow anomaly.
5. To perform Mutation Analysis of the Program Segments along with mutant history, mutation score and type of mutation by using any Code analysis Tool (JUNIT).
6. To perform Black-Box Testing for all the units contained in the architectural segments using Equivalence Partitioning, Boundary Value Analysis and Orthogonal Array testing methods.
8. To study difference between Automation Testing and Manual Testing

Text Books:


Reference Books:

CS4224:: ALGORITHMIC NUMBER THEORY AND ALGEBRA

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: Basic introduction to linear algebra and abstract algebra (though it is not presumed) is helpful to better appreciate the contents of the course. First course on algorithms.

List of Contents

A TERM-WORK containing the record of the following:

1. Problem solving based on topic like prime numbers, gcd of integers, some simple number theoretic questions
2. Modular arithmetic, Chinese remaindering applications
3. Multiplicative functions, analytical estimates of some number theoretic functions
4. Problem solving (based on topics Groups, subgroups, homomorphism, cyclic groups etc)
5. Ring, ideals, some examples of commutative rings
6. Vector spaces
7. Integral domains, finite fields
8. More on finite fields, automorphisms, Frobenius maps, some algorithmic questions...
9. Ring of univariate polynomials F[x], quotient ring F[x]/(f)
10. Berlekamp’s algorithm and more
11. Integer lattices
12. Carmichael numbers, Lagrange symbol, Jacobi symbols, Primality testing.

Text Books

1. Modern Computer Algebra by Joachim von zur Gathen, Jürgen Gerhard (Cambridge)
2. A computational introduction to Number Theory and Algebra by Victor Shoup(Cambridge)
3. A classical introduction to modern number theory by Ireland and Rosen (Springer)

Reference Books
1. Topics in Algebra by I. N. Herstein (Wiley Publishing company)
2. Algebra by Michael Artin (Pearson Prentice Hall)
CS42218::GEOGRAPHICAL INFORMATION SYSTEMS

Credits: 01  
Teaching Scheme: - Tutorial 1 Hrs/Week  
Prerequisites:

List of Practical  
A TERM-WORK containing the record of the following:  
1. Prepare a map for the selected geographical area as per topological survey.  
2. Design a spatial database for the entities related with a geographical area specified in above map.  
3. Study the connectivity of maps with spatial databases.  
4. Analyze a case study of any GIS application of your choice.  
5. Prepare a presentation on any latest GIS technology / technique / software /hardware.

Text Books  

Reference Books  
CS42229: MANAGEMENT INFORMATION SYSTEMS

Credits: 01  Teaching Scheme: - Tutorial 1 Hr/Week

List of Contents

A TERM-WORK containing the record of the following:

1. Consider any organization from any sector. Study its organizational structure and comment about it.
2. By giving examples, differentiate between operational, strategic and tactical level of management process and its effect on design information system.
3. Identify and evaluate the design considerations for the given information system.
4. Study testing and quality assurance strategies.
5. Identify cases of computer crime, hacking, and cyber theft with respect to given information system. Plan about how to avoid and deal with such kind of security threats.

Text Books


Reference Books


Additional Reading

CS42221 :: ADVANCED COMPUTER ARCHITECTURE

Credits:  01  
Teaching Scheme: - Tut 1 Hrs/Week  
Prerequisites: Computer Organization

List of Contents:

1. Introduction to Explicitly Parallel Instruction Computing (EPIC) Architecture.  
2. To study numerical based on Performance Metrics and Measures, Speedup Performance Laws.  
3. To study implementation issues of a program on any pipelined processor and their analysis.  
4. To study numerical based on Pipelining.  
5. To study implementation issues of Matrix multiplication and sorting on array processor and their analysis.  
6. To study implementation issues of a program on multiprocessor system.  
7. To study implementation issues of a multithreaded program.  
8. To study Architecture of Multithreaded processors

Text Books


Reference Books

1. Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.  
5. Richard Y. Kain, Advanced Computer Architecture  
CS42216 :: CONVERGENCE TECHNOLOGIES

Credits: 01  Teaching Scheme: - Tutorial 1 Hr/Week

Prerequisites: :

List of Contents

A TERM-WORK containing the record of the following:

Assignments :
1. Study of audio and video data.
2. Signal passing through network for voice data.
4. Study of gatekeepers in convergence technology.
5. Study of ISDN devices.
7. Study of SS7 implementation.
8. Comparison of ISDN and B-ISDN.
9. Use of frame relay in convergence.
10. Examples on convergence

Text Books

Reference Books

Additional Reading
CS42230: EMBEDDED SYSTEMS

Credits: 01

Teaching Scheme: -Tutorial 1 Hr/Week

Prerequisites: MI MPMC.

List of Contents

A TERM-WORK containing the record of the following:

1. Interface the LCD to Microcontroller
2. Understanding Different Interrupts and Programming The Interrupts
3. Programming the ADC in Microcontroller
4. Program the USART in Microcomputer.
5. Program the I2C Interface
6. Program the SPI interface.
7. Study different kinds of RESET.
8. Program the Timers for Creating the Square Wave.
9. Switching TRIACS and SCR.
10. Mini Project Design and Implementation

Text Books


Reference Books

Additional Reading
1. Microcontroller Handbook
6. Tammy Noergaard, — Embedded Systems Architecture by Elsevier
CS42233 :: IMAGE PROCESSING

Credits: 01

Teaching Scheme: - Tutorial 1 Hrs/Week

Prerequisites:

List of Practical

All the assignments should be done using ‘MATLAB’.

1. Study of different file formats e.g. BMP, TIFF and extraction of attributes of BMP.

2. Study of statistical properties- mean, standard deviation, profile, variance and Histogram Plotting.

3. Histogram equalization & modification.

4. Gray level transformations such as contrast stretching, negative, power law transformation etc.

5. Spatial Domain filtering- smoothing & sharpening filters.

6. Edge detection using Sobel, Prewitt and Roberts operators.

7. Pseudo coloring.

8. Creating noisy image and filtering using MATLAB.

9. DFT/IDFT of given image.

10. Singular Value Decomposition of given Image.
Text Books

Reference Books
CS40306:: COMPILER DESIGN

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Knowledge of C.

List of Practical

1. Assignment to understand basic syntax of LEX specifications, built-in functions and Variables.

2. Implement a Lexical Analyzer using LEX for a subset of C.

3. Implement a parser for an expression grammar using YACC and LEX.

4. Generate and populate appropriate Symbol Table.

5. Implementation of Semantic Analysis Operations (like type checking, verification of function parameters, variable declarations and coercions) possibly using an Attributed Translation Grammar.

6. Implement the front end of a compiler that generates the three address code for a simple language.

7. Generate an appropriate Target Code from the given intermediate code assuming suitable processor details.

8. A Register Allocation algorithm that translates the given code into one with a fixed number of registers. (Optional)

9. Implementation of Instruction Scheduling Algorithm. (Optional)

10. Implement Local and Global Code Optimizations such as Common Sub-expression Elimination, Copy Propagation, Dead-Code Elimination, Loop and Basic-Block Optimizations. (Optional)
Text Books

Reference Books
CS40310:: ARTIFICIAL INTELLIGENCE

Credits: 01

Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites: Data Structure

List of Practical

1. Implement Non-AI and AI Techniques
2. Implement any one Technique from the following
   a. Best First Search & A* algorithm
   b. AO* algorithm
   c. Hill Climbing
3. Implement Constraint Satisfaction Algorithm
4. Expert System in Prolog
5. Implement any two Player game.
   Simulate Blocks world problem using goal stack planning

Text Books


Reference Books

2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley
CS47308:: PROJECT STAGE 3

Credits: 06  
Teaching Scheme: - Practical  12 Hrs/Week

Aim
This course addresses the issues associated with the successful management of a software development project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and their career. The Project Work can lead to:

a. Transform existing systems into conceptual models.
b. Transform conceptual models into determinable models.
c. Use determinable models to obtain system specifications.
d. Select optimum specifications and create physical models.
e. Apply the results from physical models to create real target systems.

Overview of the Course:
1. The Student Project Group will prepare a detailed Project Report consisting Semester I Preliminary Project document along with Detailed System Design Document, Implementation and Testing Document with conclusion and future scope of the Project Work. All the documents indicated will have a prescribed format. The Project Report ideally should consist of following documents: (Exceptions may be there based on the nature of the project, especially if some of the following documents are not applicable to a particular project as determined by the project guide, coordinator and head of department).

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Project Item</th>
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<tr>
<td>1</td>
<td>Project Cover Front Page</td>
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<td>2</td>
<td>Project Completion Certificate [Institute]</td>
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<td>3</td>
<td>Project Completion Letter [In case of Sponsored Projects]</td>
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<td>List of Tables</td>
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<td>8</td>
<td>Project Synopsis [Problem Background, Existing System Details, Proposed Solution]</td>
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<tr>
<td>9</td>
<td>Feasibility Study Report</td>
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<tr>
<td>10</td>
<td>Project Plan</td>
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</tbody>
</table>
2. The Project Work will be assessed jointly by a panel of examiners consisting faculty and industry experts. The Project Groups will deliver the presentation and demonstration of the Project Work which will be assessed by the panel.

3. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate’s performance based on presentation skills, questions based on the Project Work and overall development effort taken by the candidates.

Note:
The student needs to design and develop solution for the identified technological problem in the area of Computer Engineering or Information Technology of their choice. The Project Implementation needs to be completed using best possible use of available technologies as applicable to deal with the complexity of the project. The Project Group will prepare a detailed report of the project work which will be approved by the concerned faculty member. The Project Report need to be submitted both in Hard form and Soft form in CD. The Soft Copy of the Project Report must accompany other project deliverables as well.

Assessment Scheme

<table>
<thead>
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<th>Sr. No.</th>
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<tr>
<td>1</td>
<td>System Requirement Specification</td>
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<td>Feasibility Study</td>
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<td>System Design</td>
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<tr>
<td>7</td>
<td>Presentation of the Project Work</td>
<td>20</td>
</tr>
</tbody>
</table>
Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Identify the Design within Specification and Available Resources
3. Lay Down rules to Minimise Adverse Impact of designed Solutions
4. Foresee the Impact of Design Implementation
6. Adhere to rigorous Standards laid down by Professional Engineering Bodies
CS33303:: ADVANCED JAVA

Credits: 01  

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Core Java.

List of Practical

1. Design a java application to demonstrate the use Java revision, anonymous inner classes, file handling, GUI, event handling, debugging using IDE.

2. Design a java application to demonstrate use of Multithreading, concurrency, synchronous and asynchronous callbacks, ThreadPools using ExecutorService.

3. Design a java application to demonstrate use of Collections and generics.

4. Design a java database application using multithreading and concurrency control.

5. Design a java application to demonstrate use of Servlets and JSP.

6. Design a client-server application demonstrating the use of Java I/O using sockets with GUI for configurations.

7. Design a java RMI application.

8. Designing a java application to demonstrate use of Web Services - REST and SOAP.

9. Design a java application to demonstrate dynamic invocation using reflection.

Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Select the advanced features of java in solving a complex problem.

2. Implement appropriate exception handling in code.

3. Choose the appropriate advanced java features depending on problem statement.
4. Practice an IDE like Eclipse or Netbeans for quicker coding/debugging.
5. Produce reusable and extensible design to minimise rework.
6. Construct the solution by breaking the complex problem into smaller problems.
CS33312:: PIC Microcontroller

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Microprocessor, x86, x86 Interfacing Chips.

List of Practical

1. Assignment on Program Compilation and Burning into Microcontroller.
2. Assignment on Input Output.
3. Assignment on Interrupt.
4. Assignment on LED.
5. Assignment on Timer.
6. Assignment on LCD.
7. Assignment on UART.
8. Assignment on Write and Read from EEPROM.
9. Assignment on ADC.
10. Assignment on PWM.
11. Assignment on Stepper Motor.

Text Books

1. Data Sheet www.microchip.com
2. Hitachi Data Sheet on LCD HD 44780

Reference Books

1. Microchip 18F45xx

Course Outcomes:

Upon completion of the course, graduates will be able to –

2. Utilize the Structures to effectively solve Computing Problems.
3. Design system interconnects for effective throughput.
4. Validate design outputs using standards test equipment.
5. Design Effective Automation Solutions.
6. Cooperate with diverse Teams for delivering automation Solution.
CS33313:: MOBILE APPLICATION DEVELOPMENT

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Java.

List of Practical

1. Download, Install and Configure Eclipse IDE with Android Development Tools (ADT) plug-ins and Android SDK or Android Studio or Net Beans with Android plugin.

2. Building Simple User Interface using UI Widgets such as Buttons, Text Fields and View.

3. Design an android based application using content provider.

4. Develop an android based application to implement the sequential and random file operation.

5. Develop an android based application to create simple embedded database for the student attendance and find defaulters in the class using SQLite.

6. Design an android based application to demonstrate GPS services using Google map.

7. Design an android based application to implement HTTP operations for internet communication.

8. Design an android based application to implement chat application using socket programming.

9. Design an android based application to take a snapshot by using the Camera in your mobile. Save the snapshot in the image or video format. Use Camera Media API provided Android.

10. Mini Project.

Text Books


Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to
1. Use embedded database SQLite, Flat files and Multi Media files.
2. Display the current location of a device using google map.
3. Develop the user interface.
4. Choose suitable software tools and APIs for the development of Mobile Application
5. Design and deploy mobile application using software development environment
6. Demonstrate internet based application.
CS33306:: ETHICAL HACKING AND NETWORK DEFENSE

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Fundamentals of IT, Networking, Microsoft OS, LINUX or UNIX operating systems.

List of Practical
1. Study of different type of attacks
2. Study of Ethical hacking, types of hacking, different phases involved in hacking.
3. Study of skills to become ethical hacker.
4. Study of spoofing techniques
5. Study of password cracking techniques
7. Study of spyware technology
8. Study of types of viruses, antiviruses techniques and virus detection mechanism
9. Study of Sniffing techniques and tools.
10. Study of Flooding attacks like MAC flooding, SYN flooding etc.
11. Study of Session Hijacking and prevention of session hijacking.
12. Web based password cracking techniques
14. Study of Physical security.

Text Books
Michael T Simpson – “Ethical Hacking and Network Defense”.

Course Outcomes
Upon completion of the course, the students will be able to:

1. Analyze nature and type of attack.
2. Establish type of attack on a given system.
3. Simulate different types of attacks using tools.
4. Differentiate between the type of communication services used for attack.

5. Design a secure system for protection from the various attacks by determining the need of security from various departments of an organization.

6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.
CS33310: SPRING FRAMEWORK

Credits: 01

**Teaching Scheme:** - Laboratory 2 Hrs/Week

**Prerequisites:** Java, JSP, Servlets

**List of Practical**

1. Assignment on Spring Environment Setup.
2. Assignment on Spring Hello World Example.
3. Assignment on Spring IOC Container.
4. Assignment on Spring Bean Scopes, Spring Bean Life Cycle.
5. Assignment on Spring Bean Post Processors.
6. Assignment on Spring Dependency Injection, Spring Injecting Inner Beans, Spring Injecting Collection, Spring Beans Auto-Wiring.
7. Assignment on Spring Annotation Based Configuration, Spring Java Based Configuration.
8. Assignment on Event Handling in Spring.
9. Assignment on Spring AOP Assignments.
10. Assignment on Spring JDBC assignments.
11. Assignment on Spring Web-MVC Assignments.

**Text Books**

1. *Spring Recipes – A problem solution approach* by Gary Mak, Josh Long and Daniel Rubio.
2. *Professional Java Development with the Spring Framework*, by Rod Johnson

**Reference Books**

1. *Pro Spring 3.0* by Clarence Ho, Rob Harrop.

**Course Outcomes:**

Upon completion of the course, graduates will be able to -

1. Analyze Real world problems using Spring Framework Architecture, MVC
model, Aspect Oriented Programming (AOP) and Event Handling in Web Architecture.

2. Construct formalized design patterns to effectively implement Java Enterprise Application lifecycle.

3. Create application using Spring Tool Suite, Software project management and comprehension tool like Maven.

4. Demonstrate that the business rules and validations are implemented in shorter time using this framework.

5. Acquire skills to work on real time projects in industry.

6. Use pre-built framework for rapid application development using Spring Framework MVC Applications.
CS33311: STRUTS FRAMEWORK

Credits: 01  

Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites: Java, JSP, Servlets

List of Practical

1. Building a Simple Struts Application
2. Struts validator framework
3. Setup validator framework in Struts
4. Struts validator Framework
5. Using the validator framework in struts
6. Validator framework work in Struts
7. Sing validator framework work in struts
8. Using the validator Framework
9. Fixed Value check using struts validator framework
10. Struts 2 double validator
11. Struts 2 Date validator
12. Client Side Address Validation in Struts
13. Struts 2 RequiredString validator
14. Struts 2 E-mail Validator
15. XML files used in Validator Framework?
16. struts - Framework
17. Struts 2 Validation (Int Validator)
18. Struts 2 Url Validator
19. Validation using validator-rules.xml – Struts

Text Books

1. "Jakarta Strus Live" by Rick Hightower published by SourceBeat.

Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to -

2. Explain Action Mappings, Forms, JSP Standard Tag Library, Internationalization And Localization, Input Validation and Advanced Configuration.
4. Demonstrate that the business rules and validations are implemented in shorter time using this framework.
5. Acquire skills to work on real time projects in industry.
6. Incorporate best practices for building applications with Struts.
CS33314: PROBLEM SOLVING AND PROGRAMMING

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Data structures.

List of Practical

1. Data structure review (stack, queue, linked list).
2. Graph searching techniques (DFS, BFS, IDDFS etc.) and applications of graph searching in problems in programming competition.
3. Advanced data structures union-find (including optimized algorithms like path compression), segment trees, interval trees, augmented data structures and their applications.
4. String searching algorithms.
5. Dancing links to speed up backtracking.

Text Books


Reference Books


Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Apply and practice logical ability to solve the problems.
2. Modularize the problems into small modules and then convert them into algorithms
3. Analyze algorithms and determine their time complexity.
4. Trace and code recursive programs.
5. Choose appropriate problem solving technique
6. Verify and validate the correctness of the algorithm.
CS33315:: BIG DATA TECHNOLOGIES

Credits: 01

Teaching Scheme: Laboratory 2 Hrs/Week

Prerequisites: Programming Skills

List of Practical

1. Study of Hadoop 1 / Hadoop 2 (YARN)
2. Study of hadoop distributed file system (HDFS)
3. Manipulation of data on HDFS
4. Learning Map Reduce Programming
5. Word count problem using Map Reduce Programming
6. Hands-on over Pig
7. Hands-on over Hive
8. Introduction to Hbas

Text Books

2. "Programming Pig", Allen Gates, O'Reilly

Reference Books

1. “Programming Hive”, Dean Wampler, O'Reilly
2. “HBase: The Definitive Guide”, Lars George, O'Reilly

Additional Reading

1. "Hadoop In Action", Chuck Lam, Manning Publication

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Illustrate architecture of Hadoop
2. Break down a computing problem into multiple parallel tasks
3. Explain Hadoop Ecosystem
4. Organise input data to handle it using HDFS
5. Apply map reduce programming technique to address real world problems
6. Adapt to upcoming technologies for management of complex big data problems
CS33307:: MATLAB

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites:

List of Practical (Any Ten)

1. Introduction to MATLAB, MATLAB Elements & Simple Programs and debugging concepts.

2. Write a Matlab Program for functions.

3. Write a Matlab Programs by using IF Then Else, Case, Statement, for Loop, While loop.

4. Write a Matlab Program for 2-D graph.

5. Write a Matlab Program for 3-D graph.

6. Write a Matlab Program for various Image operations.

7. Write a Matlab Program for Animations.

8. Study of MATLAB debugging commands.

9. Write a Matlab Program to create GUI.

10. Write a Matlab Program to simulate a simple circuit.

11. Write a Matlab Program to create Movie.

12. Write MATLAB Program to read sound file and adjust its parameters.

13. Write MATLAB Program to read .avi file.
Text Books

Reference Books

Course Outcomes:
Upon completion of the course, graduates will be able to -

1. Solve Mathematical equations.
2. Design GUI by using MATLAB.
3. Construct Combinational circuit.
4. Validate design outputs using standards test equipments.
5. Develop animation programs by using MATLAB.
6. Perform various operations on Image.