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 ‘F-11’
Effective from Academic Year 2014-15

Prepared by: - Board of Studies in Computer Engineering
Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS    Chairman – Academic Board

Content

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Course Structure - Module I and II</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>2.1</td>
<td>CS10102 Computer programming (Theory Course)</td>
<td>18</td>
</tr>
<tr>
<td>2.2</td>
<td>CS10302 Computer Programming (Laboratory)</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Course Structure - Module III</td>
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</tr>
<tr>
<td>4.1</td>
<td>CS20115 Discrete Structures (Theory Course)</td>
<td>25</td>
</tr>
<tr>
<td>4.2</td>
<td>CS20111 Data Structures (Theory Course)</td>
<td>28</td>
</tr>
<tr>
<td>4.3</td>
<td>CS20108 Computer Organization (Theory Course)</td>
<td>30</td>
</tr>
<tr>
<td>4.4</td>
<td>CS21109 Applied Electronics (Theory Course)</td>
<td>32</td>
</tr>
<tr>
<td>4.5</td>
<td>CS20113 Digital Electronics and Logic Design (Theory Course)</td>
<td>35</td>
</tr>
<tr>
<td>4.6</td>
<td>CS20115 Discrete Structures (Tutorial)</td>
<td>38</td>
</tr>
<tr>
<td>4.7</td>
<td>CS20113 Digital Electronics and Logic Design (Tutorial)</td>
<td>40</td>
</tr>
<tr>
<td>4.8</td>
<td>CS20311 Data structures (Laboratory Course)</td>
<td>41</td>
</tr>
<tr>
<td>4.9</td>
<td>CS20313 Digital Electronics (Laboratory Course)</td>
<td>42</td>
</tr>
<tr>
<td>4.10</td>
<td>CS27401 Mini Project</td>
<td>44</td>
</tr>
<tr>
<td>4.11</td>
<td>CS24301 VB.NET OR CS24303 C#.NET (Skill Development Course)</td>
<td>45/47</td>
</tr>
<tr>
<td>4.12</td>
<td>Elective – Soft Skills</td>
<td>-</td>
</tr>
<tr>
<td>4.13</td>
<td>CS20401 Comprehensive Viva Voce</td>
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</tr>
<tr>
<td>4.14</td>
<td>Institute Elective</td>
<td>-</td>
</tr>
</tbody>
</table>

| 5 | Course Structure - Module IV |   |
|   | Course Syllabi for Courses - Module IV |   |
| 6.1 | CS21104 Mathematical Transformations and Applications (Theory Course) | 52 |
| 6.2 | CS20110 Computer Graphics (Theory Course) | 55 |
| 6.3 | CS20105 Principles of Programming Languages (Theory Course) | 58 |
| 6.4 | CS21112 Data Communication (Theory Course) | 61 |
### Course Structure - Module V

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
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<tbody>
<tr>
<td>6.5</td>
<td>CS20114</td>
<td>Microprocessor and Interfacing</td>
<td>Theory</td>
<td>64</td>
</tr>
<tr>
<td>6.6</td>
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<td>Tutorial</td>
<td>67</td>
</tr>
<tr>
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<td>CS21104</td>
<td>Mathematical Transforms and Applications</td>
<td>Tutorial</td>
<td>69</td>
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<td>CS20314</td>
<td>Microprocessor and Interfacing</td>
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<tr>
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<td>CS20305</td>
<td>Principles of Programming Languages</td>
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<td>74</td>
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<tr>
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<td>CS20310</td>
<td>Computer Graphics</td>
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<td></td>
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<td>CS24304</td>
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### Course Syllabi for Courses - Module V

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<tbody>
<tr>
<td>8.1</td>
<td>CS30101</td>
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<td>87</td>
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<td>Theory of Computation</td>
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### Course Structure - Module VI

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### Course Structure - Module VII

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</tr>
</tbody>
</table>

13 Course Structure - Module VIII

14 Course Syllabi for Courses - Module VIII

14.1 CS40106 Compiler Design (Theory Course) 214
14.2 CS40110 Artificial Intelligence (Theory Course) 216
14.3 $Elective Group III (Theory Course)

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>227</td>
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<td>230</td>
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</table>
14.4 $SElective Group IV (Theory Course)

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<tr>
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<td>257</td>
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<td><strong>Compiler Design (Laboratory Course)</strong></td>
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<td>269</td>
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<td><strong>Artificial Intelligence (Laboratory Course)</strong></td>
<td></td>
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<td>Artificial Intelligence</td>
<td>271</td>
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<td><strong>14.9</strong></td>
<td><strong>Project Stage - III</strong></td>
<td></td>
</tr>
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<td>CS47308</td>
<td>Project Stage - III</td>
<td>272</td>
</tr>
<tr>
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<td><strong>Course Syllabi for PD Courses in TY B.Tech (Computer Engineering)</strong></td>
<td></td>
</tr>
<tr>
<td>15.1</td>
<td>CS33303 Advanced Java</td>
<td>276</td>
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<td>15.2</td>
<td>CS33312 PIC Microcontroller</td>
<td>278</td>
</tr>
<tr>
<td>15.3</td>
<td>CS33313 Mobile Application Development</td>
<td>280</td>
</tr>
<tr>
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<td>CS33306 Ethical Hacking and Network Defense</td>
<td>282</td>
</tr>
<tr>
<td>15.5</td>
<td>CS33310 Spring Framework</td>
<td>284</td>
</tr>
<tr>
<td>15.6</td>
<td>CS33314 Struts Framework</td>
<td>286</td>
</tr>
<tr>
<td>15.7</td>
<td>CS33311 Problem Solving and Programming</td>
<td>288</td>
</tr>
<tr>
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<td>CS33315 Big Data Technologies</td>
<td>290</td>
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<td>CS33307 Matlab</td>
<td>292</td>
</tr>
</tbody>
</table>
## Program Educational Objectives (PEO)

**B.Tech (Computer Engineering)**

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

<table>
<thead>
<tr>
<th>PEO</th>
<th>PEO Focus</th>
<th>PEO Statement</th>
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<tbody>
<tr>
<td>PEO1</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>PEO2</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>PEO3</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>
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<td>PEO4</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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<td>PEO5</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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| PO1 | 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. |
| PO2 | 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. |
| PO3 | 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. |
| PO4 | 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. |
| PO5 | 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. |
| PO6 | 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. |
| PO7 | 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. |
| PO8 | GA: 8: Ethics | 13. To prepare and present engineering evidence, theory and interpretations honestly, accurately and without bias. |
| PO9 | 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. |
| PO10 | GA: 10: Communication | 15. To demonstrate deep listening, learning, leadership and managerial skills to solve complex engineering problems in teams. |
| PO11 | 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.

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<tr>
<th>PO12</th>
<th>GA: 12: Project Management and Finance</th>
<th>18. To creatively devise and incorporate project-specific processes supported by rigorous standards applicable to professional engineering bodies.</th>
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### F.Y. B. Tech. Structure with effect from Academic Year 2015-16

#### Module 1

<table>
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<tr>
<th>Code</th>
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# F.Y. B. Tech. Structure with effect from Academic Year 2015-16

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

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**HS153xx : General Proficiency Courses as per following list**
## List of General Proficiency Courses

### FY B Tech

#### AY 2015-16

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CS10102:: COMPUTER PROGRAMMING

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites:

Unit 1: Introduction to Programming:

PART A: Problem solving using computers and logic design. Algorithms and their representations: flowcharts, pseudo code. Designing algorithms for problems like finding min-max, mean, median, mode, mensuration and roots of a quadratic equation. Concept of programming languages for implementing algorithms – levels of languages. Role of assemblers, compilers, linker, loader, interpreter in program execution.


PART B: Bits and bytes – importance of digital representation in computers. Number System and algorithms for inter conversions. C programming on Linux and Windows.

Unit II: Flow of Control


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: Functions

PART A: Need of functions, function declaration, definition and call. Inbuilt functions and user defined functions. Passing arguments to a function, returning values from a function. Scope of variable, local and global variable. Access specifiers. Passing arrays to functions.

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

Unit 4: Pointers and Strings (8+2 Hrs)

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: Structures and File Handling (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 sting.
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 sting.
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
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CS40106:: COMPILER DESIGN

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Prerequisites: Theory of Computation.

Unit 1: Lexical Analysis and Introduction to Syntax Analysis (8+1 Hrs)
PART B: Implementing Scanners, operator precedence parsers.

Unit 2: Syntax and Semantic Analysis (8+1 Hrs)
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: Syntax-Directed Translation and Intermediate Code Generation (8+1 Hrs)
PART B: More about translation: Array references in arithmetic expressions, case statements.

Unit 4: Code Generation (8+1 Hrs)
PART B: Generating code from dags.

Unit 5: Code Optimization and Run Time Environments (8+1 Hrs)
PART B: Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing.
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.
CS42117: Artificial Intelligence

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

Prerequisites:

Unit 1: Fundamentals of Artificial Intelligence


Part B: Criteria for Success, Turing Test.

Unit 2: Searching

Part A: Depth First Search, Breadth First Search, Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means-Ends Analysis.

Part B: Applications of Minimax Algorithm.

Unit 3: Planning


Part B: Planning Graph

Unit 4: Knowledge Representation

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


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

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)
Part B: Solving Problems based on above algorithms.

Unit 4: Machine Learning Algorithm
PART A : 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: Clustering Algorithm and recurrent Networks (7 Hrs)
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. Evaluate 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  
PART A :Introduction and Role of Neural Network (NN), Applications: Signal Processing, Pattern recognition, Medicine, Speech Production/Recognition, Business etc., Artificial Neural Networks, Bilogical 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  

Unit 3: Competitive Neural Network  
PART A :Fixed weight Competitive Neural Network, Kohonen Self Organizing Maps, Learning Vector Quantization, Counter propagation: Fully Counter propogation neural network, Forward only Counter propagation Neural network.
PART B :Applications of Self organizing Maps

Unit 4: Adaptive Resonance Theory(ART)  
PART B :Case Study: ART2 Application

Unit 5: Pattern Association  
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 be 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.

Unit 1: Basic Number Theory
PART A: Infinitely many primes in 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 upto x)

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 Z_n, integral domains, fields, vector spaces. Unique factorization in ring k[x] 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 Z[i] and Lagrange’s four square theorem, analogies between ring of integers and univariate polynomial ring, more properties of finite fields.

Unit 3: Number theoretic algorithms
PART A: Euclid’s algorithm for GCD, Extended Euclid’s algorithm, fast integer arithmetic, algorithms for modular arithmetic, fast exponentiation, finding modular inverse, finding order of element in a group, finding quadratic non-residues, algorithm for modular square-root, algorithms for discrete-log problem.

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

(9+2 Hrs)
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 (7+1 Hrs)

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 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 B:** 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)
PART 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)
PART B: Identification of Functional Levels, Services and Products in Selected Domain.

Unit 3: e-Business  
(8+2 Hrs)
PART B: Study of Process to accommodate e-Business Approach in Selected Domain.

Unit 4: Information Systems for Decision Support  
(8+2 Hrs)
PART B: Identify Decision-making Aspects in a Selected Domain with Appropriate Examples.

Unit 5: Challenges Ahead  
(8+2 Hrs)

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: Overview of Parallel Processing (8+1 Hrs)
PART A: Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors. Necessity of high performance, Constraints of conventional architecture, Parallelism in uni-processor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism
PART B: Explicitly Parallel Instruction Computing (EPIC) Architecture, Performance Metrics and Measures, Speedup Performance Laws.

Unit 2: Pipelining Processing (8+1 Hrs)
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: SIMD Computer Organization and Parallel Algorithms For Array Processors (8+1 Hrs)
PART B: Implementation issues of Matrix multiplication and sorting on array processor and their analysis.

Unit 4: Multiprocessor (8+1 Hrs)
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: Parallel Programming Techniques (8+1 Hrs)


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 of on modern and high performance computers
3. Compare the performance of different architectures.
4. Develop application 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.

Prerequisites: Computer Networks.

Unit 1: Introduction to Convergence (7+2 Hrs)
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: Protocols and Standards for Convergence (9+1 Hrs)
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: Switching networks (9+1 Hrs)
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: Frame Relay and SMDS (7+1 Hrs)
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: ATM technology (8+1 Hrs)
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)
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
5. 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 A: Geometric Model, Photometric Model, Sampling, Digitization, Elements of Digital Geometry, Image Properties, Representation
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.
PART B: Slant, KL, affine transforms. Applications of transforms in Image processing.

Unit 5: Compression fundamental (8+1 Hrs)
PART B: Elements of information theory, error free compression: VLC, JPEG compression standards Factal.

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.
CS42120 :: DATA MINING

Credits: 01  
Teaching Scheme: - 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
CS42128 :: 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 Backpropogation 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.
CS42104 :: 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.

Outcomes:
Upon completion of the course, the students will:
1. Have an in-depth understanding of artificial neural networks fundamentals.
2. Have a knowledge about various learning paradigms and models of ANN.
3. Be able to classify real problems into neural OR non-neural problem.
4. Have a good knowledge of feature extraction and selection.
5. Know about modern ANN architecture and hybrid neural systems (FNN).
CS42111: 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:

CS42124:: 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)
Reference Books
1. Topics in Algebra by I. N. Herstein (Wiley Publishing company)
2. Algebra by Michael Artin (Pearson Prentice Hall)
CS42118::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
CS42129: 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

CS42121 :: 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
CS42116 :: CONVERGENCE TECHNOLOGIES

Credits: 01

Teaching Scheme: 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
CS42130:: EMBEDDEDED 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
CS42133 :: 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: COMPILE 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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</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Cover Front Page</td>
</tr>
<tr>
<td>2</td>
<td>Project Completion Certificate [Institute]</td>
</tr>
<tr>
<td>3</td>
<td>Project Completion Letter [In case of Sponsored Projects]</td>
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<tr>
<td>4</td>
<td>Acknowledgments</td>
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<tr>
<td>5</td>
<td>Table of Contents</td>
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<td>6</td>
<td>List of Figures</td>
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<tr>
<td>7</td>
<td>List of Tables</td>
</tr>
<tr>
<td>8</td>
<td>Project Synopsis [Problem Background, Existing System Details, Proposed Solution]</td>
</tr>
<tr>
<td>9</td>
<td>Feasibility Study Report</td>
</tr>
<tr>
<td>10</td>
<td>Project Plan</td>
</tr>
</tbody>
</table>
2. The Project Work will be assessed jointly by a panel of examiners consisting of 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>
<tr>
<th>Sr. No.</th>
<th>Content</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>System Requirement Specification</td>
<td>05</td>
</tr>
<tr>
<td>2</td>
<td>Feasibility Study</td>
<td>05</td>
</tr>
<tr>
<td>3</td>
<td>System Analysis</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>System Design</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>System Implementation</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>System Testing</td>
<td>25</td>
</tr>
<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