APPENDIX A
## FINAL YEAR: INFORMATION TECHNOLOGY

### SCHEME OF INSTRUCTION AND EXAMINATION

**(RC 2016-17)**

**SEMESTER – VII**

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<th>Subject Code</th>
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<th>Scheme of Instruction Hrs/Week</th>
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<tr>
<td>IT 7.1</td>
<td>Image Processing</td>
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<td>IT 7.2</td>
<td>Principles of Compilers</td>
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<td>IT 7.3</td>
<td>Mobile Computing</td>
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<td>IT 7.4</td>
<td>Elective-I</td>
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<td>IT 7.5</td>
<td>Elective-II</td>
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<td>IT 7.6</td>
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# A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

### List of Electives

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Elective-I</th>
<th>Subject Code</th>
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<td>IT 7.4.1</td>
<td>Embedded System Design</td>
<td>IT 7.5.1</td>
<td>Geographical Information System</td>
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<tr>
<td>IT 7.4.2</td>
<td>Genetic Algorithms</td>
<td>IT 7.5.2</td>
<td>Computer Forensics</td>
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<tr>
<td>IT 7.4.3</td>
<td>Bio Informatics</td>
<td>IT 7.5.3</td>
<td>Digital Signal processing</td>
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<tr>
<td>IT 7.4.4</td>
<td>Electronic Commerce</td>
<td>IT 7.5.4</td>
<td>IT Business Methodology</td>
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## FINAL YEAR: INFORMATION TECHNOLOGY

### SCHEME OF INSTRUCTION AND EXAMINATION

**(RC 2016-17)**

#### SEMESTER – VIII

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<td>IT 8.1</td>
<td>Distributed System</td>
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<td>IT 8.2</td>
<td>Computer Cryptography and Network Security</td>
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<td>L T P# Duration (Hrs) 3 100 25 -- 25 --</td>
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</table>

* Term Work in Project is a separate Head of Passing.

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<td>IT 8.3.1</td>
<td>Web Services</td>
<td>IT 8.4.1</td>
<td>VLSI Design</td>
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<td>IT 8.3.2</td>
<td>Natural Language Processing</td>
<td>IT 8.4.2</td>
<td>Cloud Computing</td>
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<td>IT 8.3.3</td>
<td>Fuzzy Logic and Neural Networks</td>
<td>IT 8.4.3</td>
<td>Advanced Computer Architecture</td>
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<td>IT 8.3.4</td>
<td>Advanced Data Structures and Algorithms</td>
<td>IT 8.4.4</td>
<td>Storage Area Networks</td>
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IT7.1 IMAGE PROCESSING

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<th>Scheme of Examination</th>
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<tr>
<td>IT7.1</td>
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**Course Objectives:**
1. To focus on imparting knowledge about the conceptual and practical aspects of Image Processing.
2. To analyze the basic principles and mathematical preliminaries behind Image Processing Techniques.
3. To know signal Processing aspect in Image Processing.
4. To formulate the importance of colour image processing and understanding its usage.

**Course Outcomes:**
The student after undergoing this course will be able to:
1. Describe the theory underlying basic techniques of Image Processing with detailed instruction for their application.
2. Understand the concepts and principles of the Image Processing Techniques like image enhancement, restoration, compression and segmentation.
3. Be able to implement basic Image Processing algorithms.
4. To carry out simulations for various processes in Image Processing.

**UNIT -1 (12 Hours)**
**UNIT - 2**  (12 Hours)

**Filtering in the frequency domain:** Sampling and the Fourier transform of sampled function, sampling theorem, aliasing. Properties of 2D discrete Fourier transform – relationship between spatial and frequency intervals, translation and rotation, periodicity, symmetry properties, Fourier spectrum and phase angle, 2D convolution theorem. Image smoothening using frequency domain filters – ideal low pass filters, Butterworth low pass filters, Gaussian low pass filters. Image sharpening using frequency domain filters – ideal high pass filter, Butterworth high pass filter, Gaussian high pass filter.


**UNIT - 3**  (12 Hours)

Color Fundamentals. Color Models – the RGB color models, the CMY and CMYK color models, the HSI color models. Basics of Full-Color Image Processing. Image Segmentation based on color – segmentation in HSI color space, segmentation in RGB vector space, color edge detection.

**Wavelets and Multiresolution processing:** Image pyramids, subband coding, the Haar transform.

**Image compression:** Some basic compression method – Huffman coding.

**Morphological Image Processing:** Erosion and Dilation – erosion, dilation, duality. Opening and Closing, The Hit-or-Miss Transformation. Some Basic Morphological Transformation. Some Basic Morphological Algorithms – boundary extraction, hole filling, extraction of connected components, convex hull, thinning, thickening, skeletons and pruning.

**Image segmentation:** point, line and edge detection – detection of isolated points, line detection. Thresholding – foundation and Basic Global thresholding. Region based segmentation – region growing, region splitting and merging.

**UNIT - 4**  (12 Hours)

**Representation and Description:** Representation – Boundary following, chain codes, polygonal approximation using minimum parameter polygons. Boundary Descriptors – simple descriptors, shape numbers, Fourier descriptors, statistical moments. Regional descriptors - Some Simple Descriptors, topological descriptors.

**Object Recognition:** Patterns and Pattern Classes. Recognition Based on Decision-Theoretic Methods - Matching, Optimum Statistical Classifiers. Structural Methods - Matching Shape Numbers, String Matching.
Recommended Readings:
2. A.K. Jain; Fundamentals of Digital Image Processing; PHI;
4. W.K. Pralt; Digital Image Processing; McGraw Hill;

List of Experiments in Image Processing and Pattern Recognition:
1. Introduction to image processing and pattern recognition
2. Create image in Java
3. Convert a colored image to grayscale image
4. Zooming and shrinking of an image
5. Negative of an image
6. Threshold of an image
7. Histogram of an image
8. Image smoothening
9. Erosion and dilation
### Course Objectives:
1. To introduce essential theory, algorithms, and tools used in compiler construction.
2. To study the design of lexical, syntax, and semantic analysis of source files.
3. To study the construction of syntax trees, and symbol tables.
4. To understand code generation and optimization techniques.

### Course Outcomes:
The student after undergoing this course will be able to:
1. Understand how compilers translate source code to machine executable.
2. Utilize tools to automate compiler construction such as LEX and YACC.
3. Comprehend how to perform parsing (top down and bottom up).
4. Be familiar with techniques for simple code optimizations.
5. Have the knowledge to design, implement, and test a compiler for a simple language.

#### UNIT - 1

(12 Hours)

A language processing system, an overview of Assemblers, Macro processors, Linkers, Loaders, Debugger, Text editor, Compiler, Interpreter.
Introduction to Language Translator, Phases of compilation, Bootstrapping and Porting, Compiler writing tools.
A Language for specifying lexical analyzer. Study of the features and applications of LEX/FLEX tool.

#### UNIT - 2

(12 Hours)

Top down parsing: Recursive descent parsing and Predictive parsers.
Bottom up parsing: Shift-reduce parsers. Operator precedence parsers, LR parsers.
Study of YACC Tool: Programming with YACC. Combining YACC and FLEX.
UNIT - 3  
(12 Hours)  

UNIT - 4  
(12 Hours)  
Code generation: Issues in the design of a code Generator, Basic blocks and flow graphs, Next-use information, A simple Code generator, The DAG representation of Basic blocks, Peephole Optimization, Generating code from DAGS.  
Code optimization: The principle sources of optimization, Optimization of basic blocks, Machine dependent optimization, Register allocation optimization.

Recommended Readings:  
2. Aho, Ulman and Sethi; Compilers, Principles, techniques and tools; Pearson Education Asia, ISBN: 81-7808-046-X.  
3. Vinu V. Das ; Compiler design with FLEX and YACC; PHI publication, ISBN:978-81-203-3251-5  
4. Louden; Compiler Construction, Principles and Practice; Galgotia Publication, ISBN:0-534-93972-4

List of Experiments in Principles of Compilers:  
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)  
1. A program to detect tokens from user defined expression.  
2. A LEX program to find if the input is integer, real number or word.  
3. A LEX program to add line numbers for given text.  
4. A LEX program to convert decimal numbers to hexadecimal numbers.  
5. A LEX program to compute average of given set of numbers.  
6. A YACC program to parse an expression for a given grammar.  
7. A program that combines YACC and LEX.  
8. A program to obtain First and Follow for a user specified grammar.  
9. A program to obtain Leading and Trailing for a user specified grammar.  
10. To implement code generation algorithm
IT 7.3 MOBILE COMPUTING

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<tr>
<td>IT7.3</td>
<td>Mobile Computing</td>
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Course Objectives:
1. To understand the basic concepts and principles in mobile computing.
2. To be acquainted of the major layers of the mobile protocol stack.
3. To learn the basics of the major telecommunication systems GSM and DECT.
4. To understand the basic concepts of the various classes of satellites.
5. To be exposed to the concepts of Bluetooth and Wireless LAN

Course Outcomes

After completing the course the students will be able to:
1. Explain the basics of mobile telecommunication systems
2. Choose the best solution for each layer of the mobile protocol stack.
3. Describe the fundamentals of GSM and DECT telecommunication systems.
4. Identify the problems and their solutions for mobile network layer and mobile transport layer.
5. Describe the essentials of Satellite systems, Bluetooth and WAP.

UNIT - 1 (12 Hours)

Introduction: Applications, Simplified Reference model.

UNIT - 2 (12 Hours)

Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA.
Telecommunication System: GSM, DECT.
UNIT - 3 (12 Hours)

Mobile Transport Layer: Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks, Performance Enhancing Proxies.

UNIT - 4 (12 Hours)

Wireless LAN: Bluetooth.

Recommended Readings:


List of Experiments:

2. Case Study: Frequencies for radio Transmission.
3. Program to implement Minimum Shift Keying (MSK).
4. Case Study: Medium Access Control
5. Program to check orthogonality and autocorrelation of codes.
6. Case Study: Global System for Mobile Communications (GSM).
7. Case Study: Mobile IP
8. Case Study: Classical TCP improvements
9. Build an ad-hoc network using different Bluetooth devices.
10. Design a webpage using WML and WMLScript.
IT 7.4.1 EMBEDDED SYSTEM DESIGN

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<td>Embedded System Design</td>
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Course Objectives:
The subject aims to provide the student with:
1. To conceptualize the basics of embedded systems.
2. To conceptualize the basics of organizational and architectural issues of a microcontroller
3. To learn programming techniques used in microcontroller
4. To understand fundamentals of real time operating system

Course Outcomes:
The student after undergoing this course will be able to:
1. Explain about microcontrollers embedded processors and their applications
2. to write the programs for microcontroller.
3. Describe the role of embedded systems in industry.

UNIT – 1  
(12 Hours)

Introduction to Embedded Systems:
Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC (System on Chip).

The Microcontroller Architecture:
Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input/Output Ports, Counter and Timers, Serial communication, Interrupts.

UNIT – 2  
(12 Hours)

Assembly Language Programming of 8051:
Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and Interrupt Service Routine.
UNIT – 3 (12 Hours)

**Embedded / Real Time Operating System:**

UNIT – 4 (12 Hours)

**Embedded System - Design case studies:** Digital clock, Battery operated smart card reader, Automated meter reading system, Washing Machine, Microwave Owen, Automotive Embedded Systems

**Embedded software development tools:** Code generation tools, Simulator, Testing and debugger, Integrated Development Environments (IDE) for 8051 systems, Memory and Processor sensitive program and device drivers.

**Recommended Readings:**
1. M. A. Mazidi, J. G. Mazidi, R. D. McKinlay; The 8051 microcontroller & Embedded systems; Pearson
2. Kenneth J. Ayala, Dhananjay V. Gadre; The 8051 microcontroller & Embedded systems; Cengage Learning.
4. Raj Kamal; Embedded System: architecture, programming and design; TMH.
5. Frank Vahid; Tony Givargis; John Wiley; Embedded System Design;
6. Laya B. Das, Pearson; Embedded systems an integrated approach;
7. Frank Vahid; Tony Givargis; Embedded system design A Unified hardware/software Introduction.
8. Shibu K.V; Introduction to Embedded Systems; Mc Graw Hill
List of Experiments:

(At least 8 experiments should be conducted based on the broad areas listed below)

**Using Keil**
1. Write a program to send ASCII values 0,1,2,3,4,5,6,7,8,9,a,b,c,d,e to port 1
2. Write a program to toggle the bits of P1
3. Write a program to send and receive data serially
4. Programming based on arithmetic operations in 8051
5. Programming based on logical operations in 8051
6. Programming based on timers in 8051
7. Programming based on interrupts in 8051

**Based on RTOS**
1. To implement Shortest Job First Scheduling algorithm
2. To implement Priority Inheritance Protocol
3. Case Study: Reliability & Fault tolerance in RTOS

**Case Study on Embedded System**
1. Digital clock,
2. Battery operated smart card reader,
3. Automated meter reading system,
4. Washing Machine,
5. Microwave Owen,
6. Automotive Embedded Systems
IT 7.4.2 GENETIC ALGORITHMS

<table>
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<td>IT 7.4.2</td>
<td>GENETIC ALGORITHMS</td>
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Course Objective:
The subject aims to provide the student with:
1. Understanding of genetic algorithm.
2. Learn different genetic algorithms and their industrial application.
3. Know to assess the suitability of genetic algorithms for specific problems

Course Outcomes:
The student after undergoing this course will be able to:
1. Explain the fundamentals of genetic algorithm and how it can use in search problem to find approximate solution.
2. Identify which problem can be solved using genetic algorithm.
3. Apply the Advanced concepts of genetic algorithm in search problem and optimization

UNIT – 1 (12 Hours)

Introduction to Genetic Algorithms: Robustness of Traditional Optimization and Search Methods, Goals of Optimization, Difference between Genetic Algorithms and Traditional Methods, Simple Genetic Algorithm and its major operators, Example using Genetic Algorithm, Similarity Templates Schemata.


UNIT – 2 (12 Hours)

Computer Implementation of Genetic Algorithms: Data structures, Reproduction, crossover and mutation, mapping objective functions to fitness form, Fitness scaling.


UNIT – 3 (12 Hours)
Advanced Operators And Techniques In Genetic Algorithm Search: Dominance, Diploidy and Abeyance, Inversion and other Re-ordering Operators, Macro operators, Niche and Specialization, Multi objective optimization. Knowledge based techniques, Genetic Algorithms and Parallel processors, Genetic Based machine learning, Classifier systems.

UNIT – 4 (12 Hours)


Recommended Readings
3. Intelligent agent's adaptive control: Industrial applications- L.C. Jain and C.W.de Silva

Experiment List
(At least 8 experiments should be conducted based on the broad areas listed below)

1. Case study on traditional and Genetic Algorithmic approach.
2. Program to implement Cross over and mutation operations.
3. Program to map an objective functions to fitness form.
4. Program on inversion and Re-ordering operators.
5. Program to find minimum of a function using genetic algorithm.
6. Program on constraint minimization using genetic algorithm.
7. Program to implement classifier using genetic algorithm.
8. Case study on the industrial applications of the genetic algorithms
### IT 7.4.3 Bio Informatics

<table>
<thead>
<tr>
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<td>IT 7.4.3</td>
<td>Bio Informatics</td>
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#### Course Objectives:

The subject aims to provide the student with:

1. An ability to understand the broad scope of Bioinformatics.
2. An understanding of the theory and practices of computational methods of Bioinformatics.
3. An understanding of how to demonstrate the basic programming tools used in the field of genomics.
4. An ability to observe various tools used in Bioinformatics.
5. A keen interest in Bioinformatics.

#### Course Outcomes:

The student should be able to:

1. Implement Methods used in Bioinformatics.
2. Study Genome Analysis and Gene Mapping.
3. Compare Phylogenetic Analysis and Sequence Analysis.
4. Analyze various algorithms used in Bioinformatics.
5. Apply various Tools used in Bioinformatics.

#### UNIT -1 (12 hours)

**Introduction to Bioinformatics:** Introduction, Historical Overview and Definition, Bioinformatics applications, Major databases in bioinformatics, Data Management and Analysis, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology.

**Information Search and Data Retrieval:** Tools for web search, Data Retrieval Tools, Data Mining of biological databases.

**Genome Analysis and Gene Mapping:** Genome Analysis, Gene Mapping, The Sequence Assembly Problem, Genetic Mapping and Linkage Analysis, Physical Maps,
Cloning Entire Genome, Genome Sequencing, Applications of Genetic Maps, Sequence Assembly Tools, Identification of Tools in Contigs, Human Genome Project.

UNIT -2 (12 hours)

Sequence Alignment: Dot matrices and Hash coding, Dynamic programming in sequence algorithm, BLAST, FASTA.

Alignment of Multiple Sequences and Phylogenetic Analysis: Methods of multiple sequence alignment, Evaluating Multiple alignments, Applications, Phylogenetic Analysis, Methods of Phylogenetic Analysis, Tree evaluation, Problems in Phylogenetic Analysis, Dual automated tools.

UNIT -3 (12 hours)

Gene Expression and Microarrays: Working with DNA Microarrays, Clustering Gene Expression Profiles, Data sources and tools for microarrays analysis, Applications – Functional Genomes, Comparative Genomics, Medical Applications, Microarrays in Pharmaceutical industries, DNA Microarrays.

UNIT -4 (12 hours)

Determination and Analysis of Molecular Structures: Experimental structure determination technique, Visualization and representation of molecular structure, Geometrical analyses of structures.

Recommended Readings:

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. To implement sequence alignment using hash coding.
2. To implement Pairwise sequence alignment.
3. To implement Sequence similarity searching for sequences.
4. To implement multiple sequence alignment.
5. To implement Phylogenetic analysis using distance based method.
6. To implement evaluation of trees.
7. To implement microarray image analysis.
8. To implement prediction of secondary structure of proteins.
9. To implement sequence based prediction.
10. To validate 3D protein structure.
**Course Objectives:**

1. To develop an understanding of different business models of E-Commerce.
2. To develop an understanding of Electronic Payment Systems.
3. To develop an understanding of Elements of Supply Chain.
4. To develop an understanding of Security in E-Commerce.

**Course Outcomes:**

The student after undergoing this course will be able to:

1. Students would be able to analyze the concept of electronic market and market place.
2. Students would be able to understand the different Business Models.
3. Students would be able to understand different types of security threats in E-Commerce.
4. Students would be able to understand the different Applications of E-Commerce.

**UNIT - 1**  
(12 Hours)


**Planning and Launching of Online Business:** Business Models, Advantages of Bricks and Clicks business model, Superiority of bricks and clicks over pure online model, Difference between brick and mortar and pure online business model, Launching online business, Life cycle approach for launching an online business, One to One Enterprise.
UNIT - 2  (12 Hours)

**Electronic Payment System:** Traditional payment systems, Internet based payment system, Essential requirements of E-Payment System, Credit cards, Debit cards, Smart cards, EFT, Electronic or Digital Cash, E-Cheques, E Wallet, Consumer, Legal, and Business Issues.

**Payment Gateways:** Payment gateway process, Advantages and Disadvantages of Payment Gateway, Secure Electronic Transaction Protocol, Types of Payment Gateway: Cyber Cash, Net Bill, First Virtual Holdings and Virtual PIN.

**Electronic Commerce and Banking:** Changing Dynamics in the Banking Industry Open versus Closed Models, Management Issues in Online Banking, Differentiating Products and Services, Managing Financial Supply Chains, Pricing Issues in Online Banking, Marketing Issues, Back-Office Support for Online Banking.

UNIT - 3  (10 Hours)


**Electronic Commerce and Retailing:** Changing Retail Industry Dynamics, Mercantile Models from the Consumer's Perspective, Types of Purchases, Types of Consumers, Management Challenges in Online Retailing.

**Intranets and Supply-Chain Management:** Supply-Chain Management Fundamentals, Pull versus Push Supply-Chain Models, Elements of Supply-Chain Management, Integrating Functions in a Supply Chain, Managing Retail Supply Chains, The Order Management Cycle (OMC).

UNIT - 4  (10 Hours)


Recommended Readings:

1. Nidhi Dhawan; Introduction to E-Commerce; International Book House Pvt. Ltd; 2010
2. Ravi Kalakota & Andrew B. Whinston; E-Commerce; Pearson Education India

List of Experiments in E-Commerce:
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

1. An analysis of Different Ecommerce Websites
2. A Survey on Online Payment Method
3. Study of E-Commerce Softwares
4. A Survey on Enterprise Resource Planning (ERP)
5. Mini Project: Designing of E-Commerce Website
6. Case Study: Amazon.in
7. Case Study: Online Banking in India
8. Case Study: SCM in India
9. Case Study: E-Business in Action
IT 7.5.1 GIS  GEOGRAPHICAL INFORMATION SYSTEM (Elective II)

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Scheme of Instruction Hrs/Week</th>
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<tr>
<td>IT 7.5.1</td>
<td>Geographical Information system</td>
<td>3</td>
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**Course Objective:**
1. Understand the purposes of GIS and the kinds of problems to which GIS is applied.
2. Understand maps and way it is represented in digital form.
3. Understand the fundamental types of GIS data, including raster and vector data.
4. Understand the basics of data capture, storage, analysis and output in a GIS.
5. Understand the limitations of geographic information systems and of geographic data in general.

**Course Outcomes**
1. Students are able to explain the concept, terminology and practices of GIS.
2. Students are able to demonstrate how GIS data is digitally represented and how the data is processed.
3. Students are able to design, implement and manage a GIS application.

**UNIT 1**

**Introduction to GIS:** Definitions and related terminology of GIS. Evolution of GIS, Components of GIS, Approaches to the study of GIS.

**Maps and GIS:** Characteristics of maps, Plane and geographic coordinates, Map projection
Establishing a geo referencing framework for mapping locations of earth, Topographic mapping
Thematic mapping

**UNIT 2**

**Digital Representation of Geographic data:** Technical issues to digital representation of data
Database and database management system, Raster geospatial data representation
Vector data representation, Object oriented geospatial data representation, Relationship between data representation and data analysis in GIS.

**Geospatial Data Quality and Data Standards:** Concepts and definition of data quality, Components of geospatial data, Data quality assessment, Managing data spatial errors, Geospatial data standards, Geospatial data standards and GIS development
UNIT 3 (12 hrs)

**Raster Geoprocessing**: Characteristics of raster geoprocessing, Acquiring and handling raster geospatial data, Raster geospatial data analysis, Output functions of raster geoprocessing, Cartographic modeling.

**Vector Geoprocessing**: Characteristics of vector geoprocessing, Vector data input functions

Non topological GIS analysis functions, Feature based topological functions, Layer based topological functions, Vector geoprocessing output functions, Approaches to vector geoprocessing.

UNIT 4 (12hrs)

**Geo Visualization and Geospatial Information Products**: Cartography in the context of GIS, Human computer interaction and GIS, Visualization of geospatial information Principles of cartographic design in GIS, Generation of information product.

**GIS Implementation and Project Management**: Software engineering as applied to GIS, GIS project planning, System analysis and user requirement studies, Geospatial database design methodology, System implementations in technology roll out, System maintenance and technical support.


**Recommended Readings**


## IT 7.5.2 COMPUTER FORENSICS

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<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Scheme of Instruction Hrs/Week</th>
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<td>Computer Forensics</td>
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### Course Objective:

The subject aims to provide the student with:

1. Familiarization with the types and categories of Cyber Crime
2. Understand concept and scope of Computer Forensics
3. Knowledge and skill required to minimize the occurrence and severity of incidents related to forensics and cyber law.
4. An appropriate level of awareness, knowledge and skill required to minimize the occurrence and severity of incidents related to forensics and cyber law.

### Course Outcomes:

Upon completion of this course, student will be able to

1. Describe fundamental computer forensics concepts and procedures.
2. Explain how to recover hidden data for forensic analysis from Windows and Linux/Unix file systems
3. Apply digital forensic tools to discover, collect, preserve and analyze Windows and Linux/Unix digital evidence.

### UNIT – 1


### UNIT – 2


UNIT – 3

Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case

UNIT – 4

Current Computer Forensic tools: Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools. Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

Recommended Readings:

Course Objectives:
1. Understand basic concepts and methodologies in Digital Signal Processing.
2. Understand the fundamental concepts of discrete transforms.
3. Study the applications of Z Transforms.

Course Outcomes
Upon completion of this class, students should be able to:
1. Explain the concepts of signals and systems and the basic operations on them.
2. Analyse the behaviour of periodic and aperiodic signals in frequency domain using the Fourier Series and Fourier Transforms.
3. Describe the concept and characteristics of Z Transforms and its use in the analysis and applications of systems.
4. Explain the techniques of designing of Infinite Impulse Response (IIR) filters and Finite Impulse Response (FIR) filters.

UNIT -1  (12 Hours)

UNIT -2  (12 Hours)

UNIT -3  (12 Hours)
Introduction to Digital Filters. Types of Digital Filters: FIR and IIR Filters. Choosing Between FIR and IIR Filters. Filter Design Steps. Introduction. FIR Filter Design. FIR
UNIT -4 (12 Hours)


Recommended Readings:
IT 7.5.4 IT Business Methodology

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**Course Objectives:**
1. To explore the concept of Decision support system.
2. To understand the concept of ERP.
3. To understand the ethical practices in management.

**Course Outcomes:**
The student after undergoing this course will be able to:
1. Explain the concept of Management Information system.
2. Differentiate the ERP modules.
3. Describe the ERP Implementation Lifecycle.

**UNIT - 1** (10 Hours)

**Management Information Systems:** Need, Role of managers, Business and technology trends, Reengineering, Transaction management.

**Models and Decision Support:** Need, Understanding processes, Decision Support Systems (DSS), Executive Information Systems (EIS), Expert Support Systems (ESS), and Building ESS.

**Value:** Importance, source of value system, types, values, loyalty and ethical behavior, value across culture.

**Business ethics:** Nature, characteristics and needs, ethical practices in management.

**UNIT - 2** (12 Hours)

**Business modeling for ERP:** Overview, concept, significance and principles of business engineering, BRP, ERP and IT business engineering with IT, ERP and management concerns, building an MIS, Business as a system, core process in a manufacturing company, entities for data model in a manufacturing company, extended ERP.

**Enterprise - An Overview:** Integrated management information, Business modeling, Integrated business model.
**ERP : A Manufacturing Perspective:** ERP, CAD/CAM, MRP, BOM, closed loop MRP, MRP-II, JIT and Kanban, PDM, Make To Order, Make To Stock, Assemble To Order, Engineer To Order, Configure To Order.

**UNIT - 3**

**ERP Modules:** Finance, Plant management, Quality management, Materials management.

**Benefits of ERP:** Reduction of lead time, On-time shipment, Reduction in cycle time, Improved resource utilization, Better customer satisfaction, Improved supplier performance, Increased flexibility, Reduced quality costs, Improved information accuracy and decision making capability.

**ERP Implementation Lifecycle:** Pre-evaluation screening, Package evaluation, Project planning phase, Gap analysis, Reengineering, Configuration, Implementation team engineering, Testing, Going live, End-user training, Post implementation.

**Vendors, Consultants and users:** in-house implementation, Vendors, Consultants, End-users.

**UNIT - 4**

**Strategic Analysis:** Competitive environment, External agents, IS techniques to gain competitive Advantage, Product Differentiation and new products, Need for innovation, Costs and dangers of strategies, Quality management: Operations, tactics and strategy.

**Organizing Businesses and Systems:** Production Chain, Disintermediation, Auctions, Entrepreneurship, Planning.

**Information management and Society:** Individual perspective, Business perspective: Vendor, Consumer, Education and training, Social interaction, Responsibility and ethics.

**Recommended Readings:**
1. Gerald V. Post and David L. Anderson; Management Information Systems; (TMH).
2. Vinod Kumar Garg, N. K. Venkita Krishna; Enterprise resource planning.
3. Alexis Leon; Enterprise Resource Planning; TMH.
5. S.K Chakraborty; Value and Ethics for Organization.
**IT 8.1 DISTRIBUTED SYSTEM**

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<tr>
<td>IT 8.1</td>
<td>Distributed System</td>
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**Course Objectives:**

The subject aims to provide the student with:

1. Understand the major technical challenges in distributed systems design and implementation.
2. To present the principles underlying the functioning of distributed systems
3. Expose students to past and current research issues in the field of distributed systems
4. Provide experience in the implementation of typical algorithms used in distributed systems

**Course Outcomes:**

The student after undergoing this course will be able to:

1. Explain what a distributed system is, why you would design a system as a distributed system and what the desired properties of such systems are.
2. List the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions
3. Recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems

**UNIT – 1**

(12 Hours)


**The Client-Server Model:** Clients and Servers, Application Layering, Client-Server Architectures


UNIT – 2 (12 Hours)


Message Passing Communication: Communication Primitives, Message Synchronization and Buffering, Pipe, Pipe and Socket APIs, Group Communication, Multicasting


UNIT – 3 (12 Hours)


UNIT – 4  (12 Hours)

**Distributed Object-Based Systems:** Communication, Processes, Naming, Synchronization, Caching and Replication, Fault Tolerance and security issues with CORBA and DCOM. Comparison of CORBA and DCOM

**Distributed File Systems:** Communication, Processes, Naming, Synchronization, Caching and Replication, Fault Tolerance and security issues with Sun Network File System

**Distributed Document-Based Systems:** Communication, Processes, Naming, Synchronization, Caching and Replication, Fault Tolerance and security issues with World Wide Web

**Recommended Readings:**

**List of Experiments:**
(At least 8 experiments should be conducted from the list of experiments.)
1. Program to implement Single Client Single Server Chat Application
2. Program to implement Multiple Clients Single Server Chat Application
3. Program to implement Remote Method Invocation Application
4. Case study on Component Object Model (COM)
5. Case study on Distributed Component Object Model (DCOM)
6. Case study on Common Object Request Broker Architecture (CORBA)
7. Program to implement Berkeley’s Algorithm for clock synchronization
8. Case study in generating Interface Definition Language (IDL) in Java using CORBA
9. Program to implement Lamport Timestamps clock synchronization
10. Program to implement Vector Timestamps clock synchronization
IT 8.2 COMPUTER CRYPTOGRAPHY AND NETWORK SECURITY

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<td>IT 8.2</td>
<td>Computer Cryptography and Network Security</td>
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Course Objectives:
The subject aims to provide
1. An Understanding of different cryptography techniques
2. A study of different cryptography algorithms and perform cryptanalysis
3. Concepts of different network security issues
4. Ability to secure their network and message passed in the network

Course Outcomes:
The student after undergoing this course will be able to:
1. Explain different cryptographic techniques
2. Implement different algorithm for encryption
3. Illustrate how network security is achieved
4. Perform cryptanalysis of different algorithm

UNIT – 1 (12 Hours)

UNIT – 2 (12 Hours)
Block Ciphers Principles, Fiestel Structure, Data Encryption Standard, Strength of DES, Block Cipher Modes of Operation, Triple DES. Confidentiality Using Symmetric Ciphers:

UNIT – 3 (12 Hours)

UNIT – 4 (12 Hours)


Recommended Readings:


List of Experiments:

(At least 8 experiments should be conducted based on the broad areas listed below)

1. Implementation of Caesar Cipher
2. Implementation of Transposition Cipher
3. Implementation of Play fair Cipher
4. Implementation of Hill Cipher
5. Implementation of one time pad technique
6. Implementation of DES
7. Implementation of RSA
8. Implementation of Stenography
10. Study of Security analysis tools: Nessus, Microsoft baseline security analyzer, wireshark, nmap, tcpdump, networking commands.

IT 8.3.1 WEB SERVICES
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<td>IT 8.3.1</td>
<td>Web Services</td>
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**Course Objectives:**
1. To learn and understand the various concepts of Web Services.
2. To learn basics of XML which is the basic prerequisite to understand how the different documents of the respective protocols are designed.
3. To learn the different protocols used in web services and their role and importance in designing a web service.

**Course Outcomes:**
The student after undergoing this course will be able to learn:
1. How information is exchanged between applications within a distributed environment. (SOAP).
2. How the web services are described to the world over internet (WSDL).
3. How the web service is published and made known to the world over the internet. (UDDI).
4. How to explain the conversation pattern that a web service is expecting to engage in. (WSCL)
7. Transactions and the transaction protocols used in web service.

**UNIT - 1**

*(14 Hours)*

**Web Service and SOA fundamentals:** Introduction, Concept of Software as a Service(SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture(SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services , Impact and shortcomings of Web services.

**Web Services Architecture:** Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for
implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

**UNIT - 2**

(12 Hours)

**Extensible Markup Language (XML):** XML Fundamentals. XML, XML Documents, XML Namespaces. XML Schema, Processing XML.

**XML Parsing:** SAX, COM, JAXB. Xpath, XQuery.

**UNIT - 3**

(14 Hours)

**SOAP:** Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.

**Describing and Discovering Web Services:** WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI Registries, uses of UDDI Registry, Programming with UDDI UDDI data structures, support for categorization in UDDI Registries, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, deleting information in a UDDI Registry, limitations of UDDI.

**UNIT - 4**

(12 Hours)

**Conversations:** Web service conversation Language, WSCL Interface component, Relationship between WSCL and WSDL.


**Recommended Readings:**

1. Michael P. Papazoglou; Web Services & SOA: Principles and Technology; Pearson Education, 2/e.
5. R. Nagappan, R. Skoczylas, R.P. Sriganesh; Developing Java Web Services; Wiley India.

List of Experiments in Web Services:
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

1. To implement XML Schema and File
2. To study and implement XML inheritance.
3. To study and implement SOAP and WSDL.
4. To study and implement DOM.
5. To implement XML encryption
6. To implement XML query
7. Creating web service using JAVA
8. Creating web service using .NET
9. Case study on XPath, XJAXB
Course Objectives:
The subject aims to provide the students with:
1. To understand the basic of Natural Language processing.
2. To develop an understanding of various techniques used in Natural Language Processing and understand the various application areas for NLP.

Course Outcomes:
The student after undergoing this course will be able to:
1. Understand the complexities and the key issues involved in NLP
2. Understand various core techniques and their adaptations for NLP
3. Explore and propose different domains in which NLP can be applied efficiently
4. Develop new applications and techniques for NLP

UNIT - 1
(12 Hours)
Regular Expressions, Finite-State Automata, Formal Languages, Non-Deterministic FSAs, Relating Deterministic and Non-Deterministic Automata, Regular Languages and FSAs, Morphology, Finite-State Morphological Parsing, Finite-State Transducers, Sequential Transducers and Determinism. The combination of an FST, Lexicon and Rules, Lexicon-Free FSTs: The Porter Stemmer, Word and Sentence Tokenization, Detection and Correction of Spelling Errors, Minimum Edit Distance Simple (Unsmoothed) N-grams, Training and Test Sets, N-gram Sensitivity to the Training Corpus

UNIT - 2
(12 Hours)
UNIT - 3  
(12 Hours)


UNIT - 4  
(12 Hours)


Recommended readings:


LIST OF EXPERIMENTS:
1) Study of python basics. Getting and setting up various freely available datasets
2) Implement depth first and breadth first search
3) Implement a simple n-gram language model that allows n to vary from two to four
4) Implement a model that uses linear interpolation
5) Implement a model that uses Discounting for n = 1 to 4
6) To implement simple decision tree
7) To implement a simple text classification technique
8) To implement a simple text summarization technique
**Course Objectives:**

1. To provide basic introduction to concepts and methodologies of Fuzzy Logic and Neural Networks.
2. To develop knowledge about the conceptual and practical aspect of Neural Networks and Fuzzy Logic.
3. To develop a foundation that can be used for further research in Fuzzy Logic and Neural Networks.

**Course Outcomes:**

The student after undergoing this course will be able to:

1. Explain the basic concept and techniques of Neural Networks.
2. Differentiate between crisp set and fuzzy set.
3. Describe the learning rules used in Neural Networks.
4. Apply the concepts of Fuzzy Logic and Neural networks in practical applications.

**UNIT - 1 (12 Hours)**


**UNIT - 2 (12 Hours)**

organizing maps. Non-iterative procedures for association, Discrete Hopfield Network, Brain-State_in_a_box Network, Boltzmann Machine, Bi-directional Associate memory.

**UNIT - 3  (12 Hours)**


**UNIT - 4  (12 Hours)**


**Recommended Readings:**

1. Kishan Mehrotra, Chilukuri Mohan, and Sanjay Ranka; Elements of Artificial Neural Networks by Penram International Publishing (India)
2. John Yen and Reza Langari,Fuzzy Logic, Intelligence, Control and Information; Pearson Education
4. Neural Networks: A comprehensive Foundation, - By Simon Haykin, Pearson Education
5. Introduction to Artificial Neural Networks, - By Jacek M. Zurada, Jaico PublishingHouse

**List of Experiments in Data Compression:**

(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

1. Implementation of basic logic gates using Neural networks
2. Designing a Neural Network to simulate any Boolean function.
3. Implementation of Perceptron Learning Algorithm
4. Implementation of Back propagation Algorithm
5. Implementation of Hebbian rule
8. Implementation of an application using Neuro Fuzzy techniques.
### IT 8.3.4 ADVANCED DATA STRUCTURES AND ALGORITHMS

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<td>IT 8.3.4</td>
<td>Advanced Data</td>
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<td>Structures and Algorithms</td>
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**Course Objective:**
1. To understand the need and use of advanced concepts in data structures.
2. To study the design and implementations of algorithms for advanced data structures.
3. To learn efficient parallel and probabilistic algorithms.

**Course Outcomes:**
After completing this course students will be able to:
1. Explain the concepts of advanced data structures.
2. Describe various implementations and operations on advanced data structure concepts like trees, heaps, tries, digital trees etc.
3. Apply different types of parallel and probabilistic algorithms.

#### UNIT 1 (12 Hours)

#### UNIT 2 (12 Hours)

#### UNIT 3 (12 Hours)
B-Trees: Definitions of m-way search trees Searching an m-way search trees Definitions and properties of B-tree Insertion into B-tree Deletion from b-tree Splay Trees Digital search trees, Binary tries Patricia Tries: Searching, Insertions and Deletions.
UNIT 4

(12 Hours)

Introduction to parallelism models: Simple algorithms for parallel computers CRCW and EREW algorithms, Brent’s theorem and work efficiency. Probabilistic Algorithms: Expected versus average time Pseudorandom generation, Buffon’s needle numerical integration, Probabilistic counting, Monte Carlo algorithms

Recommended Readings:
3. Graph Theory with application to engineering and computer science by DeoNarsingh, Charles E Millican. MGh, PHI, ISBN: 978-81-203-0145-0

List of Experiments

Experiment 1 WAP to implement Stack ADT using Linked list with the basic operations as Create(), IsEmpty(), Push(), Pop(), IsFull() with appropriate prototype to a functions

Experiment 2 WAP to implement Queue ADT using Linked list with the basic functions of Create(), IsEmpty(), Insert(), Delete() and IsFull() with suitable prototype to a functions

Experiment 3 WAP to generate the binary tree from the given inorder and postorder traversal.

Experiment 4 WAP to generate the binary tree from the given inorder and preorder traversals

Experiment 5 WAP to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques,
   a. Linear probing
   b. Quadratic probing
   c. Random probing
   d. Double hashing/rehashing
   e. Chaining

Experiment 6 BST WAP for Binary Search Tree to implement following operations:
   a. Insertion
b. Deletion
   i. Delete node with only child
   ii. Delete node with both children

   c. Finding an element

   d. Finding Min element

   e. Finding Max element

   f. Left child of the given node

   g. Right child of the given node

   h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

**Experiment 7 (AVL Trees and Red-Black Trees)**

I. WAP for AVL Tree to implement following operations: (For nodes as integers)
   a. Insertion: Test program for all cases (LL, RR, RL, LR rotation)
   b. Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1)
   c. Display: using set notation.

**Experiment 8 (B-Trees)**

I. WAP to implement insertion, deletion, display and search operation in m-way B tree
   (i.e. a non-leaf node can have atmost m children) for the given data as integers (Test the program for m=3, 5, 7).

II. WAP to implement insertion, deletion, display and search operation in m-way B tree
   (i.e. a non-leaf node can have atmost m children) for the given data as strings (Test the program for m=3, 5, 7).

**Experiment 9 (Min-Max Heaps, Binomial Heaps and Fibonacci Heaps)**

I. WAP to implement insertion, deletion and display operation in Min-Max Heap for the given data as integers.

II. WAP to implement Make_Heap, Insertion, Find_Min, Extract_Min, Union, Decrease_Key and Delete_Key operations in Binomial Heap for the given data as strings.
IT8.4.1 VLSI DESIGN (Elective IV)

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<tr>
<td>IT8.3.4</td>
<td>VLSI Design</td>
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Course Objective:
1. To study various aspects of VLSI Design
2. To understand working of MOS Transistor under various bias.
3. To understand various semiconductor Technology processes.
4. To understand VHDL.
5. To understand verification Testing of MOS Circuits.

Course Outcomes:
1. To analyse the characteristics of MOS device under dc Bias.
2. To implement Digital Circuits using VHDL.
3. To verify ATPG Techniques on to digital Circuits.
4. To Design circuits for CMOS Transistor.

**UNIT -1 (12 Hours)**


**UNIT - 2 (12 Hours)**


**UNIT - 3 (12 Hours)**

**UNIT - 4** (12 Hours)


**Recommended Readings:**

2. Neil H.E. West and Kamran Eshraghian; Principles of CMOS VLSI Design; Prentice Hall of India, 1995
3. Douglas Pucknell and Kamran Eshraghian; Basic VLSI Design; Prentice Hall of India, 1990

**List of Experiments**

1. Introduction to VHDL and VLSI Design
2. Use of NAND and NOR Gates for realizing other gates using VHDL.
3. Design of Half adder and Full adder using VHDL
4. 4: 1 MUX Design using VHDL
5. Solving of a SOP Expression using VHDL
6. Asynchronous D-Flip Flop using VHDL
7. Decade Counter using VHDL
8. Serial Shift Register using VHDL
Course Objectives:
1. Analyze the components of cloud computing showing how business agility in an organization can be created
2. Evaluate the deployment of web services from cloud architecture
3. Critique the consistency of services deployed from a cloud architecture
4. Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.

Course Outcomes:
The student after undergoing this course will be able to:
1. Explain the principles of Cloud Computing.
2. Describe the architecture of Cloud Computing Resources.
3. Demonstrate the applications of Cloud Computing for Business.
4. Apply the skills and knowledge to incorporate agility in an organization.

UNIT - 1  
(12 Hours)

UNIT - 2  
(10 Hours)
Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages.

UNIT - 3  
(12 Hours)
Management of Cloud Services: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)

UNIT - 4 (12 Hours)

Cloud IT Model: Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO).

Recommended Readings:


List of Experiments in Cloud Computing:
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

1. To demonstrate practically all the services of the Cloud
2. To develop & deploy our own application on Cloud
3. To install and configure HORTONWORKS SANDBOX HADOOP by using Oracle VirtualBox on Windows Operating System
4. Create an application (Ex: Word Count) using Hadoop Map/Reduce.
5. To Configure & Implement OwnCloud platform to demonstrate the concept of PaaS and SaaS.
6. Case Study: PAAS(Facebook, Google App Engine)
7. Case Study: Amazon Web Services.
8. Case Study: Aneka.
Course Objectives:
1. To understand concept of parallelism.
2. To give students an insight into the various types of processors and their internal architecture.
3. To familiarize the students, how modern computer systems work and are built.

Course Outcomes:
The student after undergoing this course will be able to:
1. Understand various types of processor along with their internal architecture.
2. Learn how modern systems are built.

UNIT - 1 (12 Hours)
**Introduction:** Von Neumann architecture, need for high speed computing, how do we increase the speed of computers? Some interesting features of parallel computers.

**Solving Problems in Parallel:** Utilizing temporal parallelism, Utilizing Data Parallelism, Comparison of Temporal and Data Parallel Processing, Data Parallel processing with specialized processors.
Parallel computer structures, Architectural classification schemes, Parallel processing applications

**Principles of pipelining:** Linear pipeline processor, Non-linear pipeline processors, Instruction and Arithmetic pipeline design, principles of designing pipelined processors.

UNIT - 2 (12 Hours)
Structures and Algorithms for Array Processors: Introduction to SIMD Computer Organization, Interconnection networks, parallel algorithms for array processors

Associative array processing: Associative memory organization.

UNIT - 3 (12 Hours)
Multiprocessors Architecture and Programming: Functional structures, Interconnection networks, Cache coherence and solutions, Interleaved memory organization, Multiprocessor operating systems, Language features to exploit parallelism, detection of parallelism in programs
IBM Blue Gene Supercomputer.

UNIT - 4 (12 Hours)
Core level parallel processing: Generalized structure of chip multiprocessors (CMP), cache coherence in CMPs, Intel Core i7 architecture. CMPs using interconnection networks: Ring interconnection of processors, Ring bus CMPs, Intel Xeon Phi Coprocessor architecture. General purpose graphics processing unit (GPGPU).

Recommended Readings:
1. Hwang and Briggs; Computer architecture and parallel processing; TMH, ISBN:0-07 031556-6
2. Parallel Computers – Architecture and Programming; V. Rajaraman and C. Siva Ram Murthy; PHI, 2/e
4. Kai Hwang; Advanced computer architecture; TMH, ISBN: 0-07-031622-8

List of Experiments in Advanced Computer Architecture:
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

Case studies(3 No.s) of various super computers and high performance computing devices.
Parallel and distributed programs using NVIDIA (5 No.s)
Simulation of various pipelining techniques. (3 No.s)
IT 8.4.4 STORAGE AREA NETWORK

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Scheme of Instruction Hrs/Week</th>
<th>Scheme of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT 8.4.4</td>
<td>Storage Area Network</td>
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</table>

Course Objectives:
The subject aims to provide the student with:
1. Understand the necessity for storage area networks.
2. Understand the appropriateness of the networked storage options
3. Knowledge of the architecture of backup/recovery and virtualization

Course Outcomes:
The student after undergoing this course will be able to:
1. Explain the need for storage area networks.
2. Choose best option for given application environment

UNIT - 1 (12 Hours)
Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages; Case study: Replacing a server with Storage Networks; The Data Storage and Data Access problem; The Battle for size and access.

Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels.

UNIT - 2 (12 Hours)
Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems; Availability of disk subsystems. The Physical I/O path from the CPU to the Storage System; SCSI.

Fiber Channel Protocol Stack; Fiber Channel SAN; IP Storage. The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

UNIT - 3 (12 Hours)
Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fiber Channel and NAS.
Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network

UNIT - 4  (12 Hours)

Overview, creating a Network for storage; SAN Hardware devices, The fiber channel switch, Host Bus adapters; Putting the storage in SAN; Fabric operation from a Hardware perspective.

The switch’s Operating system, Device Drivers, The Supporting the switch’s components, Configuration options for SANs. Planning for business continuity.

Recommended Readings:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller; Storage Networks Explained; John Wiley & Sons, 2003.


3. Richard Barker and Paul Massiglia; Storage Area Network Essentials: A Complete Guide to understanding and Implementing SANs; John Wiley India, 2002

4. Marc Farley; Storage Networking Fundamentals; Cisco Press, 2005

List of Experiments in Storage Area Networks:
(At least 8 experiments should be conducted from the list of experiments. A certified journal reporting the experiments conducted should be submitted at the end of the term)

1. Case Study of a Storage Area Networks
2. Study of a NAS hardware Architecture
3. Implementing Local File System
4. Implementing a network file system
5. Implementation of storage virtual systems in a block level
6. Implementation of storage virtual systems in a file level
7. Study of Switch’s operating system
APPENDIX C
QUESTION PAPER PATTERN

Syllabus in each subject will have 4 units.

Question paper shall be drawn as follows:

<table>
<thead>
<tr>
<th>Question No</th>
<th>From Units</th>
<th>No. of Questions to be Set</th>
<th>No. of Questions to be Answered</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>1-2</td>
<td>3 x 20 marks</td>
<td>2 x 20 marks</td>
<td>Each unit shall have minimum 20 marks</td>
</tr>
<tr>
<td>4-6</td>
<td>3-4</td>
<td>3 x 20 marks</td>
<td>2 x 20 marks</td>
<td>Each unit shall have minimum 20 marks</td>
</tr>
<tr>
<td>7-8</td>
<td>1-4</td>
<td>2 x 20 marks</td>
<td>1 x 20 marks</td>
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<tr>
<td></td>
<td></td>
<td>8 - 160 marks</td>
<td>5 - 100 marks</td>
<td></td>
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</tbody>
</table>

SAMPLE QUESTION PAPER

SUBJECT:                                      MARKS: 100

MAXIMUM DURATION: 3 hours

Instructions to the candidates:

1.

2

Part –A (Questions to be drawn from units 1 & 2)

Answer any TWO questions from the following: 2 x 20 = 40 Marks

Question-1 .................................................20 Marks

a)  
b)  
.

Question-2 .................................................20 Marks

a)  
b)  
.

Question-3 .................................................20 Marks

a)  
b)  
.
Part –B (Questions to be drawn from units 3 & 4)

Answer any TWO questions from the following: 2 x 20= 40 Marks

Question-4 .................................................20 Marks
  a) ......................................................
  b) ......................................................
  ......................................................

Question-5 .................................................20 Marks
  a) ......................................................
  b) ......................................................
  ......................................................

Question-6 .................................................20 Marks
  a) ......................................................
  b) ......................................................
  ......................................................

Part –C (Questions to be drawn from all units i.e. units 1 - 4)

Answer any ONE question from the following: 1 x 20= 20 Marks

Question-7 .................................................20 Marks
  a) ......................................................
  b) ......................................................
  ......................................................

Question-8 .................................................20 Marks
  a) ......................................................
  b) ......................................................
  ......................................................